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SPECTRUM ORBIT UTILIZATION PROGRAM DOCUMENTATION:
SOUP5 VERSION 3.8 USER'S MANUAL - VOLUME I
(CHAPTERS I THROUGH V)

CR-174889

FINAL REPORT

JUNE 10, 1985

J. DAVIDSON, H. R. OTTEY, P. SAWITZ AND
F. S. ZUSMAN

PREPARED UNDER CONTRACT NO. NAS3-22885
FOR NASA LEWIS RESEARCH CENTER

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Silver Spring, Maryland 20910

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I. INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of the SOUP5 Version 3.8 Technical Manual is to describe the underlying engineering and mathematical models as well as the computational methods used by the SOUP5 analysis programs, which are a part of the R2BCSAT-83 Broadcast Satellite Computational System which was developed for use at the Regional Administrative Radio Conference held in Geneva in June of 1983. Included in this manual are the algorithms used to calculate the technical parameters, and references to the technical literature. Not included are a detailed discussion of how to use and interpret the output of the SOUP5 analysis programs or detailed descriptions of the inputs and hardcopy (printed) outputs of the SOUP5 programs or summary descriptions of the programs themselves. These are fully documented in the SOUP5 Version 3.8 User Manual. Nor is there a description of the program code and structure or the program's data structures (including the COMMON blocks and binary file interfaces) which are documented in the SOUP5 Version 3.8 Programmer's Manual.

1.2 R2BCSAT-83 COMPUTATIONAL SYSTEM OVERVIEW

The SOUP5 programs provide the plan analysis capability of the R2BCSAT-83 Computational System which was designed to satisfy the computational requirements of the 83 RARC. The system provides the following capabilities:

- Requirements File Maintenance
- Data Base Maintenance
- Beam Fitting
- Plan Synthesis
- Plan Analysis
- Report Generation/Query

This section provides a brief description of each of these functions.

The ITU has collected the broadcast satellite service requirements information from each administration in ITU Region 2. This includes such information as the locations and rain zones of test points for the service areas in the plans to be developed. These data have been keyed and are now maintained in a data base. They are available for report generation, querying, and as input to the computational routines.

The technical parameters for the conference as well as plans under consideration are maintained in a data base which is accessible for report generation, querying, and input to computational routines. The data base also includes the results of the Beam Fitting and Synthesis Modules.

The Beam Fitting Module of the system computes the parameters of the beam from a specified satellite location which best fits a set of points defining a service area. The outputs of this program for a large number of service area and satellite location combinations are in the data base.

The Plan Synthesis Module permits a planner to develop downlink plans. These plans are stored in the data base and are used as input to the Plan Analysis Module by means of an interface program.

The Plan Analysis Module consists of the SOUP5 system described in this manual. SOUP5 computes the aggregate interference (up, down, and total)

for all the service areas in a plan. A plan can come from the Plan Synthesis Module or be generated manually by a planner. The printed outputs of this module are summary and detailed reports as well as diagnostic information. The module also generates a binary output file for use by the Report Generation/Query Module. SOUP5 is written in FORTRAN and currently runs on the PRIME 400, IBM 370 compatible computers, the VAX 11/780 and the SIEMENS computer at the ITU.

The Report Generation/Query Module permits a planner to query the data base to determine the values of selected parameters or to generate reports on a preformatted or ad hoc basis using data from any part of the data base - Requirements, Technical Parameters, Results, or Analysis Results.

1.3 SOUP5 SYSTEM SUMMARY

The principal purpose of SOUP5 is to compute the system mutual interference between a large number of broadcast satellite links operating at the same or overlapping frequencies between ground stations at specified locations through satellites in specified orbital positions. Since mutual interference is the main limiting factor in the use of the geostationary arc by many systems operating in the same frequency band, SOUP5 is a most valuable tool in the optimization of spectrum-orbit utilization.

An additional purpose of SOUP5 is to compute certain associated quantities, such as power flux density and received power, which, while not directly related to mutual interference, nevertheless are useful in the analysis of satellite communication systems.

SOUP5 is designed primarily to be used with systems in the Broadcasting-Satellite Service (BSS).

SOUP5 can handle as many as 300^{+} service areas, 2400^{+} possible feederlink transmitters (FLT) and 2400^{+} earth station receivers (ESR) in one run. Each link must be described in terms of its geometrical and

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+These numbers can be changed at implementation.

communication parameters. Some of the more significant parameters considered are carrier frequency, polarization, frequency block allocations, channelization schemes, antenna gain patterns, antenna diameters or beamwidths, and ground terminal and satellite locations.

The standard output is a set of interference reports for up, down, and total aggregate interference. A report giving intermediate results is optionally available. Extensive detailed printout for the subprograms in the system are available as debug options.

1.4 HISTORY

The Spectrum Orbit Utilization System (SOUP) was originally developed by General Electric, Space Systems Organization, Valley Forge Space Center, with funding provided by NASA and the FCC,, in 1969/70 as part of a study of the technical and economic aspects of spectrum-orbit utilization under Contract No. OEP-SE-69-102.[1] This work was first monitored by the Office of Telecommunications Policy, Executive Office of the President, with funding also supplied by NASA and the FCC. Later, the responsibility for this effort was transferred to NASA. The system was written for use on the 360/44 computer. In June 1971, ORI, primarily under NASA sponsorship with some assistance from the NTIA, started to adapt the system for use on the 360/95 computer and to make several modifications to enhance its utility as a tool in a study of domestic communication satellite systems. A document describing the modified SOUP was published in 1974.[2] A 1980 document describes further enhancements.[3] An updated document describing the enhanced version (SOUP3), which can be used to analyze the interference between systems, transmitting television, telephony and data, was published in 1981.[4] This manual describes the technical details of the version of the system which is called SOUP5 Version 8* which has been designed to handle broadcast satellite systems only.

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*SOUP4, an enhanced version of SOUP3, was superseded by SOUP5 Version 1 before it was distributed to the user community.

1.5 FORMAT OF THIS REPORT

Section II, (Overview) describes the organization, capabilities, processing sequences, and processing and data options of the SOUP5 system. Section III (Geometry) gives the details of the geometric calculations. Section IV (Antenna Gains) describes the various antenna gain algorithms used. Section V (Rain Attenuation) discusses the rain attenuation and depolarization calculations. Section VI (Equivalent Gain, Transmitter Power and Received Power) details the calculations of transmitter power and received power flux density. Section VII (Channelization and Protection Ratio) describes the channelization options, interference categories, and protection ratio calculations. Section VIII (Margins, Aggregate Interference and Grouping) describes the generation of aggregate interference and margins. Appendix A describes the equivalent gain calculation in detail. Appendix B describes how to enter a protection ratio template.

II. SOUP5 TECHNICAL OVERVIEW

The SOUP5 analysis system currently consists of three programs and their associated input and output files. The flow chart in Figure 1 shows the input and output files used by SOUP5. Each file is labeled with the Data Set Name (DSN) used in the JCL which accompanies the program (see Appendix C of the User's Manual). For files without a DSN (i.e. Sysout = A for printout, or DD * for input in JCL stream) a descriptive name is enclosed in parentheses. Each arrow is labeled with the FORTRAN unit number of the file as implemented on IBM computers and the name of the internal program variable containing the FORTRAN unit number. The unit numbers themselves are read from files P1.DATA, P2.DATA and P3.DATA so that individual installations may change them to suit their own conventions. The following paragraphs summarize the components -- both programs and data -- of the system.

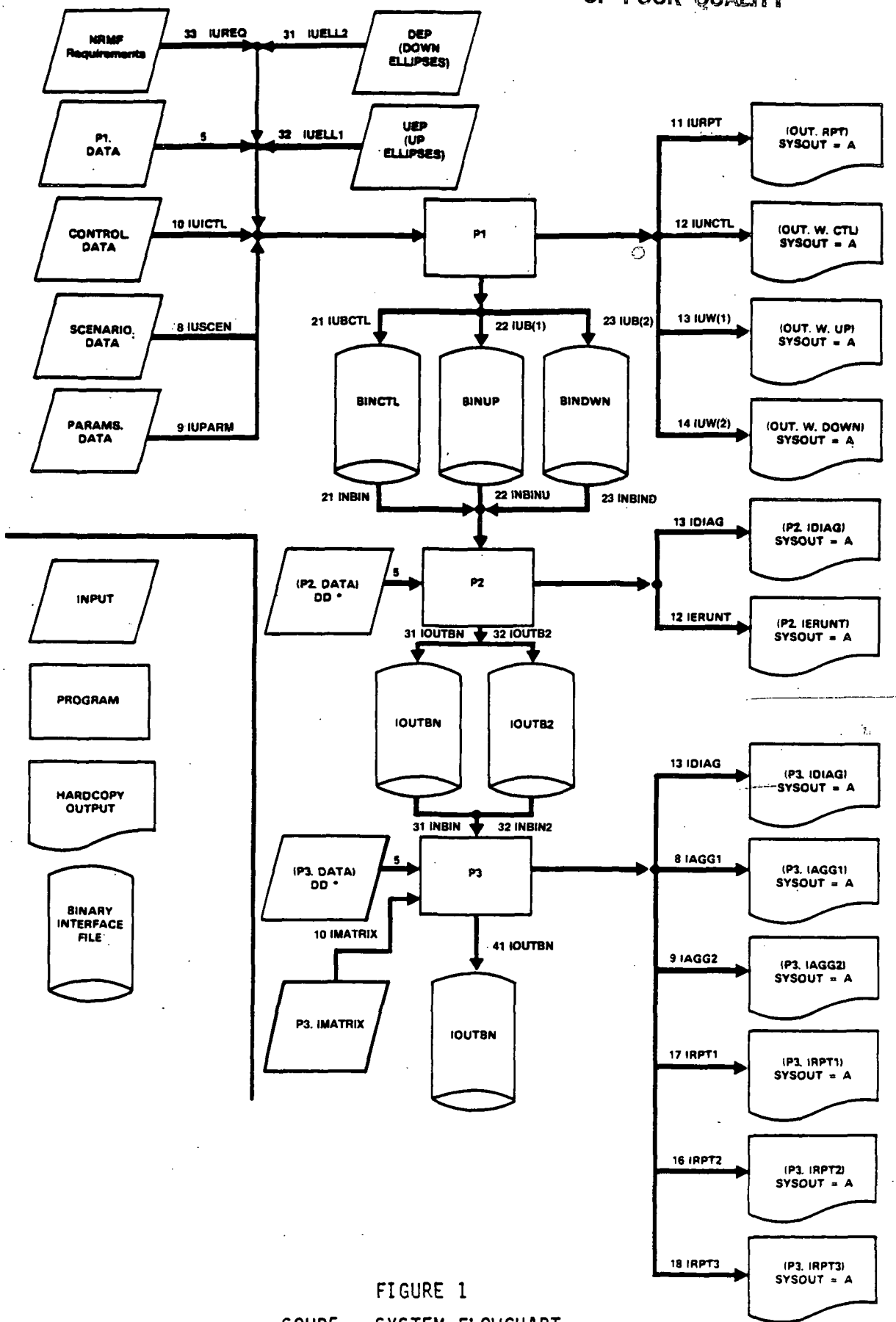

FIGURE 1

SOUP5 - SYSTEM FLOWCHART

2.1 INPUT FILES

SOUP5 reads six input files in program P1 and one in Program P3 to assemble the data necessary to perform subsequent calculations. These files (except those written by the IFRB) contain sequentially organized, card image data. The Program 1 files are the following.

- System and Run Control Data:
  - DATA.P1 - Contains error message formats, file unit assignments, and other internal program P1 data.
  - DATA.CONTROL - Contains
    - Name of scenario-plan for this run
    - Process up and/or down option
    - Reports to be written
    - Debug printout flags for programs P1 through P3

- R2BCSAT-83 Data Base Data:
  - DATA.SCENARIO contains a set of scenario-plans. Program P1 selects and processes one of them. Up to 300+ service areas, 2400+ feederlinks and 2400+ earth station receivers can be accommodated in any one plan.
  - DATA.PARAMETERS contains
    - RARC Parameters
    - Channelizations
    - Protection Ratio Sets
    - Point Sets (alternatives for the Requirements files)
    - Ellipses (Alternatives for the official ellipse files)

+Numbers can be changed during installation.

- Antenna Characteristics Sets
- Gain Tables

- ELLIPSE FILES (one for up and one for down) contain official IFRB ellipses

- REQUIREMENTS FILE contains data from requirements forms submitted to the IFRB

Below we list the P3 input file

- P3.IMATRX

  - This file allows the user to inhibit the interference calculations between the specified service areas in either direction. It may be created by the user, or by the synthesis program.

Each of these files is fully described in Chapter 3 of the SOUP5 Version 3.8 User's Manual.[5]

2.2 PROGRAMS

The three programs comprising SOUP5 are:

Program 1 - Selects the data from the data base which are needed for the run and assembles them into a form usable by programs P2 and P3, echo printing the selected data while checking and editing them for completeness and consistency.

Program 2 - Performs "non-cross" calculations: unit conversions (e.g., dB to numerics); transformation to Cartesian coordinates; calculations of protection ratios by interference category; determination of interference categories by channel family; computations of on-axis gains, transmitter power, etc.

Program 3 - Performs "cross" calculations (i.e., for up, each satellite vs. all feederlink test points; for down, each earth station receiver test point vs. all satellites). Calculations performed include: gain, received signal power, attenuation, C/I and margines. Produces summary aggregate interference reports for up, down, and total.

Each of these programs is summarized below.

2.2.1 Program 1

As explained above, Program 1 reads the six input files, selects the needed data, checking and editing them, and assembles them into a form usable by Program 2 and 3.

The main program in Program 1 invokes in sequence the following top-level subroutines:

INIT - Read DATA.P1 and initialize the run
PRCTL - Process control inputs in DATA.CONTROL
PRSCEN - Process scenario level data and scenario description in DATA.SCENARIO
PRRARC - Process RARC parameters in DATA.PARAMS
PRSERV - Process scenario service areas and point overrides in DATA.SCENARIO
PRCHAN - Process channelization data in DATA.PARAMS
PRPROT - Process protection ratio data in DATA.PARAMS
PRPNTS - Process point sets and points in DATA.PARAMS and Requirements
PRBEAM - Process ellipse data in DATA.PARAMS and the Ellipse File
PRANT - Process antenna characteristics in DATA.PARAMS
PRGAIN - Process gain tables in DATA.PARAMS
PRSIZE - Process up/down table sizes.

Typically these top-level subroutines incorporate the steps delineated in the following algorithm, depending on the type of data being processed:

PRXXXX (Process data type XXXX)

- Initialize - Write the input and binary echo report subheadings; initialize the control and table data
- Get the next needed key from the program key storage tables
- Read through the sequential input file until the record(s) with the needed key are located. If any are not located, report the error
- Write the input report entries to OUT.RPT
- Resolve data overrides from the tabled overrides
- Put the referenced keys into the program key storage tables, returning indices
- Perform data lookups, conversions, edits and verifications, while reporting any errors which occur
- Table the data required by program P2 with all overrides, indices, and edits
- Continue the above subprocesses until all the needed data are located, reported, edited, and tabled
- Skip to the end of the data of type XXXX in the parameter input file
- Write the binary data needed for program P2 and the corresponding binary echo report records from tabled data.

2.2.1.1 Hierarchical List of Program 1 Upper Level Subroutines

Below we list and summarize the Program 1 subroutines and their calling hierarchy. The subroutines are listed in two sections. The first section presents a hierarchicaral listing of the highest level subroutines. The listing shows the flow of processing but does not list or describe the "tool" subroutines. These subroutines perform various housekeeping functions, but do not participate in the logic flow of Program 2. These subroutines are listed below the higher level subroutines. Each subroutine is documented more fully in section II-E of the SOUP5 Programmer's Manual.

1. Main
    2.1 INIT - Initializes constants and tables
    2.2 PRCTL - Process Control Cards
        3.1 PRNCTL - Process P2 to P5 Control Cards
    2.3 PRSCEN - Process Scenario and Description
        3.2 PRSCDS - Process Scenario Description
    2.4 PRRARC - Process RARC Parameters
    2.5 PRSERV - Process Service Area
        3.3 RRSERV - Read and Report Service Area Cards
        3.4 PRPATH - Process Up and Down Path Data
            4.1 PPRTOV - Process point overrides
    2.6 PRCHAN - Process Channelization Cards
        3.5 RDCHNZ - Process Channelization Cards
        3.6 RDCHF - Process Channel Family Records
        3.7 WBCHAN - Write Channelization Data
    2.7 PPROT - Process Protection Ratio Templates
        3.8 RRPROT - Read, Report and Template Protection Ratio Tables
        3.9 WBPROT - Write Protection Ratio Tables
    2.8 PRPNTS - Process point set input cards
        3.10 RDPSET - Process needed point set
        3.11 RDPNTS - Process needed points
        3.12 WBPNTS - Write point set tables
    2.9 PRBEAM - Process Ellipse Input and create Ellipse Table
        3.13 RDBEAM - Read, Report and Table Beam Data
    2.10 PRANT - Process Antenna Input and create Tables
        3.14 RDANT - Read and Report needed Antenna records
    2.11 PRGAIN - Process Gain Tables
        3.15 RRGAIN - Read, Report and Store needed Gain tables
            4.2 RRGRT1 - Read, Table, and Report Gain Record Type 1
            4.3 RRGRT2 - Read, Table, and Report Gain Record Type 2
        3.16 WBGAIN - Write Gain Tables
    2.12 PRSIZE - Process and Write Up and Down Table Sizes

2.2.2 Program 2

Program P2 converts all the variables to units suitable for use in Program P3, does all the calculations which involve only one service area at a time, and checks for errors.

The program performs the following functions:

- Transforms all ground and satellite positions from latitude and longitude to earth-centered Cartesian coordinates.

- Converts all values expressed in decibels to numerical values (except for a few).

- Reads the control and table files and, after necessary conversions, writes them out for use by Program 3.

- If the user desires, prints a graph of gain as a function of off-axis angle for each gain table used in the run.

- Produces extensive diagnostic output at the user's option.

- Checks for errors in the data, prints warnings when an error is found, and sets the stop code to values depending on the seriousness of the error.

- Calculates the on-axis gains and beamwidths of all antennas.

- Calculates the basis vectors of the antenna beam plane for all satellite antennas, and the orientation angle of the beam major axis in the beam plane. The orientation angle may be specified directly as an input or by use of a reference point latitude and longitude.

- Calculates transmitter power if the user has specified EIRP, C/N, or PFD as input. Antenna noise temperature can be specified as an input or the figure of merit (G/T) can be given.

- Calculates on-axis beam unit vectors.

- Calculates a nominal wavelength for each channel family and interference categories (e.g. co-channel, upper adjacent) between channel families. Checks to ensure the RARC channelization parameters have not been violated.

- Calculates the protection ratio for each interference category using the selected template.

- Writes out all the data needed by Program 3.

2.2.2.1 Subroutine Hierarchy and Summary

The calling hierarchy of the subroutines in Program 2 is listed below. Each routine is called by the last preceding subroutine of the next (numerically) lower level.

2.2.3 Program 2

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V

```
   MAIN - Drives Program-2
1.1      INIT - Initiates constants and I/O Unit numbers
2.1           CTBLRW - Drives reads and writes of control and tables
3.1                RWCNTL - Reads and writes control tables
3.2                RWSNRA - Reads and writes scenario data
3.3                RWSNDS - Reads and writes scenario description
3.4                RWRARC - Reads and writes RARC Parameters
3.5                RWSVA - Reads and writes service area data
3.6                RDPRAT - Reads protection ratio template
3.7                RDBEAM - Reads beam tables
3.8                RWANT - Reads and writes antenna tables
3.9                RWGTBL - Reads and writes gain tables
3.10               RWGETB - Reads and writes gain entry table
4.1                     PRGRA - Print graphs of gain table
```

```
5.1                    GAINA - Calculates off-axis antenna gains
3.11             RWRATN - Reads and writes rain attenuation tables
3.12             RWTBSZ - Reads and writes up/down table sizes
1.2    TPATH - Drives reads, calculations and writes of Path and Point data
2.2          RDPATH - Reads Path related data
2.3          RDCHNL - Reads, converts, and edits channel data
3.13                 INCAT2 - Calculates nominal frequencies and interference
                     category tables
2.4          GENPRT - Calculates Protection ratios
3.14                 CPRAT - Interpolates protection ratio templates
2.5          PRPTH - Processes path related data
3.15                 POSITN - Finds satellite Cartesian coordinates
3.16                 POSITN - Finds aimpoint Cartesian coordinates
3.17                 RANGE - Finds satellite on-axis beam
3.18                 ORIENT - Drives Orientation angle calculation (for
                     non-circular satellite antennas)
4.2                       ELPSE - Sets Ellipse orientation angle
5.2                            LATLON - Finds reference point antenna coordinates
5.3                            ELTLN - Finds orientation angle reference points
5.4                            TRNFRM - Finds antenna beam plane base vectors
3.19                 BMWGOA - Finds on-axis gain of satellite antennas
3.20                 MAXCRD - Finds maximum chord for maximum Phi/Phi0
2.5          WRFRBW - Writes nominal wavelength and interference category
             tables
2.6          WRPRAT - Writes protection ratio ratios
2.7          RWPST - Reads and writes end point table
2.8          RWPOIN - Reads, calculates and writes ground point data
3.21                 POSITN - Finds Cartesian coordinates of earth stations
3.22                 BMWGOA - Finds earth station on-axis gains and antenna
                     beamwidths
3.23                 RANGE - Finds earth station on-axis beams
3.24                 POWER - Finds earth station transmitter powers
4.3                       RPWCN Finds Received power for C/N and PFD calculations
5.5                            RANGE - Finds earth-station-satellite range
5.6                            PHIS - Finds satellite antenna off-axis angles
5.7                            SIGMA - Finds relative orientation angle
```

5.8 GAINA - Finds off axis antenna gains

5.9 PHIS - Finds elevation angle

5.10 ATTENU - Finds rain attenuation

5.11 GNEQU - Finds equivalent gain

2.9 WRPATH - Writes path related data

2.2.4 Program P3

Program P3 reads the interference matrix and then performs the following "cross" functions:

- For each satellite vs. ground point
  - Looks up the interference category (e.g. co-channel, upper-adjacent).
  - Does no calculations where the channels are non-interfering.
  - Does no calculations when the interference matrix specifies inhibition of interference between the service areas.
  - At the user's option, does no interference calculation when the phi/phi0 (the off-axis angle divided by the beamwidth) of either antenna is greater than an input value.
  - At the user's option, does no interference calculation for same administration, same satellite position, same channel family (grouped runs only).
  - Calculates slant range, off-axis angle and orientation angle relative to the major axis of the ellipse.

- Calculates the copolarized and cross-polarized transmit and receive gains using the selected gain tables.

- Calculates the equivalent gain, rain attenuation and received power.

- Allows the user to specify up and down parameters (e.g. frequency, channelization) independently.

For up calculations only

- Determines the weakest feederlink transmitter (FLT) in the satellite's own ground point set to determine carrier power and the strongest FLT's in the other ground point sets to determine the interfering powers for use in the carrier-to-interference calculations.

- For both up and down

- Sums all the interference powers taking grouping into account.

- Calculates the carrier to interference ratios and margins for all the interference categories.

- Determines the worst interfering service areas in all five interference categories.

- Produces summary reports for up, down, and total aggregate interference.

- Writes all inputs, intermediate results and final results to a binary file for use by a report generator.

2.2.3 Subroutine Hierarchy and Summary

The calling hierarchy of the subroutines in Program 3 is listed below. Each routine is called by the last subroutine of the next higher lower level.

2.2.3.1 Program 3

L
E
V

Main - Reads interference matrix and drives Part 3
1.1 INIT - Initiates constants and I/O
2.1 CTBLRW - Drives reads and writes control tables
3.1 RWCNTL - Reads and writes control tables
3.2 RWSNRA - Reads and writes scenario data
3.3 RWSNDS - Reads and writes scenario description
3.4 RWRARC - Reads and writes RARC parameters
3.5 RWSVA - Reads and writes service area data
3.6 RWANT - Reads and writes antenna table
3.7 RWGTBL - Reads and writes gain tables
3.8 RWGETB - Reads and writes gain entry table
3.9 RWRATN - Reads and writes rain attenuation tables
3.10 RWTBSZ - Reads and writes up/down table sizes
1.2 UP - Drives uppath calculations
2.2 READIN - Drives reads of path and point related data
3.11 RDPSD3 - Reads path related data
3.12 RWFRBW - Reads and writes interference category and nominal wavelength tables
3.13 RWPRAT - Reads and writes protection ratios
3.14 RWPST - Reads and writes endpoint tables
3.15 *RDPOIN - Reads point set data*
2.3 INIT3G - Initializes aggregate interference results
2.4 INIT3P - Initializes cross calculation results
2.5 CHKCRD - Checks if maximum Phi/Phi0 is exceeded
2.6 RPOWER - Finds received power relative to one watt transmitter power

3.16 RANGE - Finds slant range
3.17 PHIS - Finds off-axis angle for earth antenna
3.18 SIGMA - Finds relative orientation angle
3.19 PHIS - Finds off axis angle for satellite antenna
3.20 GAINA - Finds off axis antenna gains
3.21 PHIS - Finds elevation angle
3.22 ATTENU - Finds rain attenuation
3.23 GNEQU - Finds equivalent gain
2.7 BSTWST - Selects feederlink to be used in interference calculations
2.8 WRSLTS - Writes intermediate cross calculation results
2.9 WRTAGU - Prints up aggregate interference report
3.24 ERLOC - Calculates Earth station Latitude and Longitude
1.3 DOWN - Reads point data and drives downpath calculations
2.10 READIN - Drives reads of path and point related data
3.25 RDPSD3 - Reads path related data
3.26 RWFRBW - Reads and writes interference category and nominal wavelength tables
3.27 RWPRAT - Reads and writes protection ratios
3.28 RWPST - Reads and writes endpoint tables
2.11 INIT3P - Initializes cross calculation results
2.12 CHKCRD - Checks if maximum Phi/Phi0 exceeded
2.13 RPOWER - Finds received power relative to one watt transmitter power
3.29 RANGE - Finds slant range
3.30 PHIS - Finds off-axis angle for earth antenna
3.31 SIGMA - Finds relative orientation angle
3.32 PHIS - Finds off-axis angle for satellite antenna
3.33 GAINA - Finds off-axis antenna gains
3.34 PHIS - Finds elevation angle
3.35 ATTENU - Finds rain attenuation
3.36 GNEQU - Finds equivalent gain
2.14 WRSLTS - Writes intermediate cross calculation results
2.15 WRTAGD - Prints down aggregate interference report
3.37 ERLOC - Calculates Earth station Latitude and Longitude
2.16 WRATGT - Prints total aggregate interference report
3.38 ERLOC - Calculates Earth station Latitude and Longitude

2.3 HARDCOPY AND BINARY OUTPUTS

Each of the programs produce various hardcopy and binary outputs, as summarized below:

2.3.1 Program 1 Outputs

There are two types of outputs from Program 1:

- Formatted reports echoing the card image inputs and the binary outputs
- Binary outputs to Program 2

Specifically, the outputs of Program 1 are:

- OUT.RPT - Formatted report echoing the selected card image inputs, with error messages to assist in debugging the data, including:
  - Control Data
  - Scenario Level Data
  - Scenario Description
  - RARC Parameter
  - Protection Ratio Template Table
  - Protection Ratio Entry Table
  - Beam Table
  - Antenna Characteristics Table
  - Gain Table
  - Gain Entry Table
  - Up/Down Table Sizes
- OUT.B.UP and OUT.W.UP
- OUT.B.DOWN and OUT.W.DOWN

  Binary outputs for Program 2 and their corresponding formatted reports for up/down dependent data including:

- Feederlink/Downpath Table
- Channelization Table
- Channel Family Table
- Channel Table
- Point Set Table
- Points Table

Each of the report outputs is discussed in detail in Chapter 4 of the SOUP5 Version 3.4 User's Manual[5].

2.3.2 Program 2 Outputs

There are three types of outputs from Program 2:

- Hardcopy diagnostic outputs
  Hardcopy error message outputs
- Binary outputs to Program 3

Specifically the outputs of Program 2 are:

- P2.IERUNT - A formatted report containing messages to warn the user of errors in the input data

- P2.IDIAG - A formatted report containing diagnostic output requested by the user

- P2.IOUTBN and P2.IOUTB2 - Binary output for Program 3 containing all control and data variables.

The error messages and gain table graphs are described in detail in Chapter 4 of the SOUP5 Version 3.8 User's Manual[5]. Chapter 4-F of the Programmer's Manual describes the P2.IDIAG outputs.

2.3.3 Program 3 Outputs

There are four types of outputs from Program 3:

- Hardcopy diagnostic outputs
- Hardcopy aggregate interference summary reports
- Hardcopy detail reports
- Binary outputs for yet-to-be-defined report generators.

Specifically, the outputs from Program 3 are:

- P3.IDIAG - A report containing the diagnostic output requested by the user
- P3.IAGG1 - The aggregate interference summary reports for up and total interference
- P3.IAGG2 - The aggregate interference summary report for down interference
- P3.IRPT1, P3.IRPT2, P3.IRPT3 - Detail reports giving the detail results of each link equation calculation. The last, P3.IRPT3, is only written for scenarios using grouping
- P3.IOUTBN - Binary output for use by report writing programs containing the results of the link equations.

Program 3 outputs are fully documented in Chapter 4 of the SOUP5 Version 8 User's Manual[5]; P3.IDIAG in Chapter 4-F of the Programmer's Manual.

2.4 TECHNICAL CAPABILITIES

The SOUP5 Version 3.8 system can handle aggregate interference calculations involving up to 300 service areas, with up to 2400 feederlink transmitters (FLTs) and 2400 earth station receivers (ESRs).

The FLTs and ESRs can be allocated to the service areas in any manner except that no one area can have more than 50 ESRs and 50 FLTs. A service area may be totally independent of the others, or sets of service areas may be linked into groups which coordinate their transmission in frequency blocks. Grouping is described in Section VIII.

Calculations for up and down interference are totally independent so that a service area may have different channelizations, satellite positions (for possible future implementation of intersatellite links), satellite antenna ellipses, polarizations, and ground point sets for up and down. If both up and down interference are calculated in the same run, the aggregate results are totalled.

2.5 TECHNICAL PROCESSING SEQUENCE

First all calculations involving only one service area or related to the whole scenario (up and down) are done in SOUP5 Program 2. These include:

- Antenna on-axis gains
- Transmitter power
- Antenna beamwidth
- Channelization, nominal wavelength and interference categories
- Protection ratios
- Satellite elliptical antenna beam base vectors, and ellipse major axis orientation.

Next, in Program 3, all cross calculations, (i.e., those calculations involving more than one service area) are done. The order in which each pair of service areas is processed differs between the up and down calculations, as explained below, but the sequence of the cross calculations is the same, and is the following:

- Initialize all computed outputs to default values

- Set interference categories. If the two service areas have non-interfering channelizations, no further cross calculations are done.

- If the interference matrix (an input) indicates no interference between the service areas, no further calculations are done.

- Calculate slant range. If the satellite and the ground point are over the horizon from each other by more than HORIZ (an input parameter), no further calculations are done*.

- Calculate satellite and ground antenna off-axis angles. Pointing tolerances are incorporated in such a way as to minimize the C/I ratios

- For satellite elliptical antenna beams, calculate the relative orientation angle between the ellipse major axis and the projection of the ground point in a plane perpendicular to the antenna beam

- Calculate satellite and ground antenna gains

- Calculate satellite elevation angle

- Calculate rain attenuation and depolarization

- Calculate equivalent gain

- Calculate received power

- Increment total interference

*If a ground point (ESR or FLT) is over the horizon from its own satellite, the user is warned and the calculation continues. No valid results (i.e. not involving the over-the-horizon points) are affected.

Uppath cross calculations are done in the following sequence:

- Fix on one satellite
- Calculate the received power from all FLTs in its own service area (carrier power)
- In reality only one carrier FLT can be used at a time, so we choose which one to use as follows
  - If the FLT transmitter power is set directly as watts, or calculated from a desired EIRP, the weakest received power is designated as the carrier. This is consistent with SOUP's worst-case-analysis design
  - If the FLT transmitter power is set directly from a desired C/N, then the received power from all FLTs will be equal, unless the rain attenuation at one or more FLTs exceed the allowable rain margin (an input value). In this case, the received power from these rain-limited FLTs will be less than that needed for the desired C/N. We assume that these FLTs will not be used while the rain attenuation exceeds the allowed margin, so we use the strongest received power as the carrier.
  - If the FLT transmitter power is set from desired PFD, we use the strongest received power as the carrier.
- From each interfering service area we calculate the received power from all FLT's, designate the strongest signal as the interference from that service area.
- The signal from the satellite's own carrier FLT is also incremented into the total interference in all appropriate non-cochannel categories.

- After summing all the interference on one satellite, go on to the next satellite.

Because there is only one transmitter per service area on downpath calculations the processing sequence is much simpler.

- Fix on one Earth Station Receiver (ESR)

- Calculate the received power from its own satellite, and designate this as the carrier.

- Calculate the received power from the other satellites and increment the power into the total interference. Also increment any non-cochannel signal from own satellite into the total interference.

After all the cross calculations are done for each satellite (for up) or ESR (for down), the interfering powers are summed by category for purposes of aggregate interference.

Details of the calculations summarized above are given in Section III through VIII.

2.6 TECHNICAL OPTIONS

The SOUP5 system gives the user a large number of calculation and input options. These are described in detail in the SOUP5 Version 3.8 User's Manual[5] but those relevant to this document are shown below. In parentheses after each item is a note showing where in the input data option is specified. Further details on each specification can be found in Chapter 4 of the User's Manual.

- Calculations in a run may be made for up only, down only, or both. In the latter case, total aggregate interference is calculated. (Record 1 of Control file)

- Transmitter power may be specified directly, by EIRP, by Power Flux Density (PFD) at the input to the receiving antenna or by carrier to noise ratio (C/N) at the output of the receiving antenna. If C/N is specified, noise temperature can be specified directly, or as the figure of merit (G/T). The maximum rain margin to be used in the C/N and PFD calculation may also be specified. See Section VI for details. (Records 2, 5-3, 5-5, and 5-7 of Data.Scenario. Antenna noise temperature is set in the antenna section of the parameter file. Maximum rain margin for up calculations is set in Record 2 of the scenario file. For down, the maximum rain margin is set in Record 3 of the RARC section of the parameter file.)

- Gain fall-off at the satellite beam edge (Delta-G) is specified for the whole scenario but can be overridden at the service area level. (Records 1, 5-3, and 5-5 of Data.Scenario, and Record 1 of RARC section of parameter file.)

- Earth antenna pointing tolerance is specified in units of the antenna beamwidth. (Records 1, 5-3 and 5-5 of Data.Scenario and Record 1 of RARC section of parameter file.)

- Satellite antenna pointing error is specified as an angle. (Records 1, 5-3 and 5-5 of Data.Scenario and Record 1 of RARC section of parameter file.)

- Antenna aperature efficiency is specified for each antenna. (Antenna Record of Data.Params.)

- Antenna gain patterns may be specified in a number of ways. See Section IV for details. (Antenna and Gain Pattern section of Data.Params.)

- The nominal frequency used for all calculations, can be set to the lowest, highest or median channel center frequency of a family. (Record 3 of Data.Scenario.)

- Channel's peak-to-peak deviation, bandwidths, noise bandwidths and top baseband frequency may be specified. (Channelization section of Data.Params.)

- Protection ratio curves are specified. (Protection Ratio section of Data.Params and Record 1 of Scenario file.)

- Group assignment can be specified. See Section VIII for details. (Option to use grouping on record 3 of Scenario file. Individual group assignments on Record 5-1 of same file.)

- For non-group assignment runs the user may choose not to include any interferer with the same administration code, satellite longitude, and channel family. (Record 3 of Data.Scenario.)

- The user may request that no interference be calculated if the Phi/Phi0 for either antenna is greater than an input value (Record 3 of Data.Scenario)

- Through the use of an interference matrix, the user can inhibit interference calculations between any two service areas in either direction. (Interference matrix file.)

- Circular or linear polarization can be specified. For linear polarization, the angle is specified. (Record 2 of Data.Scenario for circular/linear; Records 2, 5-3 and 5-5 of Data.Scenario for angle.)

- The percent of worst month number is specified for the rain attenuation calculations. (Record 1 of Data.Scenario.)

- The user may choose to include or not to include rain attenuation in the received power calculation. (Record 2 of Data.Scenario.)

- The polarization reference point may be set at either the subsatellite point or the satellite antenna aim poinmt (only relevant when using rain attenuation with linear polarization). (Record 2 of Data.Scenario.)

- The user may specify calculation of interference into one specific channel only. (Record 3 of scenario file.)

- The user may request the SOUP only calculate interference into a selected set of service areas. (Records 9-11 of Data.Control.)

III. INPUT FILES

Most users only need concern themselves with DATA.SCENARIO and P3.IMATRX which contain the details of the plans and DATA.CONTROL which is used to select a plan to process. Users who wish to test changes in the available technical parameters, point sets, or ellipses, may want to maintain their own versions of DATA.PARAMS.

The input files contain sequentially organized, card image data (except for the IFRB provided data):

- System and Run Control Data:
  - DATA.P1 - Contains error message formats, file unit assignments, and other internal Program 1 data.
  - DATA.P2 - Contains file unit assignments for Program 2
  - DATA.P3 - Contains file unit assignments and report page size for Program 3.

- DATA.CONTROL
  - Name of scenario-plan for a run
  - Process up and/or down option
  - What reports will be written
  - Scenario Data Overrides
  - Debug printout flags for P1 to P5.

- R2BCSAT-83 Data Base Data:
  - DATA.SCENARIO contains a set of scenario-plans. P1 selects and processes one of them
  - DATA.PARAMS contains
    - RARC Parameters
    - Channelizations
    - Protection Ratio Sets
    - Point Sets (alternate for the IFRB Requirements File points)
    - Ellipses (alternate for the IFRB DEP and UEP files of down and up ellipse)
    - Antenna Characteristics Sets
    - Gain Tables

- Interference Matrix - P3.IMATRX

  This file allows the user to inhibit interference calculations between selected service areas. The matrix may be produced by the synthesis program or arbitrarily by the user.

- IFRB produced files
  - NRMF, Requirements File
  - DEP, downlink ellipses
  - UEP, uplink ellipses

Each of these files is discussed on the following pages.

3.1.1 DATA.P1 (Unit 5)

This file contains program-dependent data and should not be modified except for the first two and last fifty nine records, which may be installation dependent. The complete file is documented in the SOUP5 Programmer's Manual. The layout of the first two and last fifty-nine records are as described below.

First two records - contain the FORTRAN I/O unit assignments to be used in Program P1.

Record Characters			
	01	IO-Unit Assignments - Record #1	
1-20	05	Filler	PIC X(20)
21-25	05	IUICTL Data.Control input unit	PIC 99999
26-30	05	IUSCEN Data.Scenario input unit	PIC 99999
32-35	05	IUPARM Data.Parameters input unit	PIC 99999
36-40	05	IURPT Output unit for the formatted listing of the required input cards with error and check/edit messages	PIC 99999
41-45	05	IUWCTL Output unit for the formatted echo print of the non-up/down-dependent binary data passed to P2, with additional debug information such as associated keys.	PIC 99999
46-50	05	IUW(1)	PIC 99999
51-55	05	IUW(2) Output units for the formatted echo prints of the up and down data (respectively) which is passed to P2, with additional debug information such as associated keys.	PIC 99999

Record Characters				
56-60	05	IUBCTL		PIC 99999
		Output unit for the non-up/down-dependent P1-P2 interface binary file. Corresponds to INBIN in P2.DATA		
61-65	05	IUB(1)		PIC 99999
66-70	05	IUB(2)		PIC 99999
		Output units for up and down P1-P2 interface binary files. Correspond to INBINU and INBIND in P2.DATA, respectively.		
71-75	05	IUELL1		PIC 99999
		Input unit for the up IFRB ellipse file		
76-80	05	IUELL2		PIC 99999
		Input unit for the down IFRB ellipse file		
	01	IO unit assignments - Record #2		
1-5	05	IUREQ		PIC 99999
		Input unit for the IFRB requirements file.		

Between these records and the records documented below, there are a large number of program dependent records, which are documented in the Programmer's Manual.[5]

59th from last Record - This record contains the characters which are used to separate the file types in DATA.PARAMS. Currently these values are set to asterisks ('*').

	01	Termination-characters-record	
1-2	05	Two-character-termination	PIC XX
3-5	05	Three-character-termination	PIC XXX
6-9	05	Four-character-termination	PIC XXXX
10-80	05	Filler	PIC X(71)

Record Characters			
	58th from Last Record		
	01	Protect-from over/underflow	
1-20	05	Filler	
20-25	05	Largest power of 10 the computer can store as a real number	PIC 9999.9
	57th from last Record		
	01	Number-of-scenario- override-protection-records	
1-30	05	Filler	PIC X(30)
31-35	05	Number-of-scenario-protections	PIC 99999
	Last 56 Records		
	01	Protect-scenario-field-from-control override record	
1-30	05	Label-of-protected-field	PIC X(30)
31-35	05	Protection Flag	1=override allowed, 0=not allowed

3.1.2 DATA.P2 (Unit 5)

This file contains I/O unit assignments for Program 2. It should not be changed by the user, only by the installation.

First Record

Record Character			
	01	I/O unit assignments	
1-5	05	INBIN Binary Control input from Program 1 (corresponds to IUBCTL in DATA.P1)	PIC 99999
6-10	05	INBINU Binary up data input from Program 1 (corresponds to IUB(1) output in DATA.P1)	PIC 99999
11-15	05	INBIND Binary down data input from Program 1 (corresponds to IUB(2) output in DATA.P1)	PIC 99999
16-20	05	IOUTBN Control and Point Data Binary output for Program 3 (corresponds to INBIN in DATA.P3)	PIC 99999
21-25	05	IERUNT Formatted print output for error messages	PIC 99999
26-30	05	IAGG1 (not used)	PIC 99999
31-35	05	IAGG2 (not used)	PIC 99999
36-40	05	INBIN2 (not used)	PIC 99999
41-45	05	INBIN3B (not used)	PIC 99999
46-50	05	IOUTB2 Path data binary output for Program 3 (corresponds to INBIN2 in DATA.P3)	PIC 99999

Record Character			
51-55	05	IDIAG Formatted print output for diagnostic data	PIC 99999
56-80	05	Not used	

Second Record

Not used but must be here

3.1.3 DATA.P3 (Unit 5)

This file contains I/O unit assignments and report page sizes for Program 3. It should not be changed by the user, only by the installation.

Record Characters			
	01	First Record I/O unit assignments	
1-5	05	INBIN Input unit for control and point Binary data from Program 2 (corresponds to IOUTBN in DATA.P2)	PIC 99999
6-10	05	INBINU (not used)	PIC 99999
11-15	05	INBIN (not used)	PIC 99999
16-20	05	IOUTBN Output unit for binary data for use by report generator	PIC 99999
21-25		Not used	PIC 99999
26-30	05	IAGG1 Output unit for formatted up and down aggregate interference summary report	PIC 99999
31-35	05	IAGG2 Output unit for formatted total aggregate interference report	PIC 99999
36-40	05	INBIN2 Input unit for binary path data from Program 2 (corresponds to IOUTB2 in DATA.P2)	PIC 99999
41-45	05	INBIN3B (not used)	PIC 99999
46-50	05	IOUTB2 (not used)	PIC 99999
51-55	05	IDIAG Formatted print output for diagnostic data	PIC 99999
56-60	05	IRPT1 Formatted print output for Detail Report #1	PIC 99999

Record Characters			
61-65	05	IRPT2	PIC 99999
		Formatted print output for Detail Report #2	
66-70	05	IRPT3	PIC 99999
		Formatted print output for Detail Report #1	
		Cross polarized (Block allocation only)	
	Second Record		
1-5	05	Lines	PIC 99999
		Number of lines per page for output reports	

3.2 DATA.CONTROL

FILE NAME: DATA.CONTROL Unit IUICTL

This file contains the control data that are used to determine: which scenario will be run, whether to perform up and/or down calculations, error-severity stop codes, the generation of debug printouts in programs P1 through P5; and overrides for scenario records 1-3.

RECORD CHARS.					
	01	Process and Output Control Card (Record 1)			
1-8	05	Selected-Scenario-Code		PIC X(8)	
9	05	Process-Uppath-Flags		PIC X	(Y,N)
10	05	Process-Downpath-Flags		PIC X	(Y,N)
11-12	05	Stop-if-error-greater-than-value		PIC 99	
	05	P1-Report-Request Flags			
		10	Input Echoes (on unit IURPT)		
13			15 Control	PIC X	(Y=Print)
14			15 Scenario Plan	PIC X	N or blank
15			15 Scenario description	PIC X	don't print
16			15 RARC parameters	PIC X	
17			15 Service Area	PIC X	
18			15 Point Overrides	PIC X	
19			15 Channelization	PIC X	
20			15 Protection Ratios	PIC X	
21			15 Point Sets	PIC X	
22			15 Ellipses	PIC X	
23			15 Antennas	PIC X	
24			15 Gain Tables	PIC X	
25			15 Summary of errors	PIC X	
26		10	Echo of P1.Data on unit IUWCTL		
		10	Echos of Binary output. The reports below are primary useful for checking the input to program P2		
27			15 Control	PIC X	(Y,N)
28			15 Scenario	PIC X	
29			15 RARC Parameters	PIC X	

30		15	Service Area	PIC X
31		15	Protection Ratio	PIC X
32		15	Ellipses	PIC X
33		15	Antenna	PIC X
34		15	Not used	PIC X
35		15	Gain Tables	PIC X
36		15	Table sizes	PIC X
37		15	Not used	PIC X
38		15	Path Table	PIC X
39		15	Channelization	PIC X
40		15	Point Set	PIC X
41-80		10	Filler	

RECORD
CHARS.

	01	P2-control-data-card (Record 2)			
1-2		05	Stop-if-error-greater-than-value	PIC 99	see note on page 3-22
3-80		05	Debug-printout-switch occurs 78	PIC 9	see note on page 3-22
	01	P3-control-data-card (Record 3) (same as P2)			
	01	P4-control-data-card (Record 4) (same as P2)			
	01	P5-control-data-card (Record 5) (same as P2)			

The following records allow the user to override selected scenario level items in the scenario to be processed and to request that the interference calculations be done only into a selected set of service areas. If the user does not desire these functions, the control file may end here. The records allow the user to override selected data items from the first three records of the scenario. The records are in the same format as the records being overridden. Any field which has a value in it, will override the corresponding field in the scenario record (see pages 3-28 to 3-36 below.) In order to protect the integrity of the planning process, each installation will designate (in Data.Pl) which fields may or may not be overriden at this level and provide this information to the user. If the user tries to override a protected field, SOUP5 will ignore the override and print a warning. To change such fields, the user must generate a new scenario.

Control Overrides
Scenario Card 1
(Optional)

RECORD CHARS.	RECORD DESCRIPTION	FORMAT	COMMENT
	01 &Scenario-Record-1-Override		
	03 Card-1		
1-8	++05 Scenario-key	PIC X(8)	Identifier
9	05 Cardtype	PIC X	=1 (Scenario)
	05 RARC-parameter-data		
10-13	10 RARC-parameters-set-key	PIC XXXX	
	10 RARC-parameter-overrides		(overrides RARC values if not blank)
	15 Antenna-and-beam parameters		
14-17	20+* [E-ant-pointing-tolerance]	PIC .999	fraction of beam-width: used for antenna off-axis angle calculations
18-21	20+* [S-ant-pointing tolerance]	PIC 9.99	degrees: used for antenna off-axis angle calculations
22-25	20 [E-ant-rota-tional-tolerance],	PIC 9.99	degrees (not used in SOUP)
26-29	20 [S-ant-rota-tional-tolerance]	PIC 9.99	degrees (not used in SOUP)
30-33	20+ [Delta-G-to-edge of beam]	PIC 9.99	dB cannot be negative

All variables marked with a "+" can be overridden at the service area level.

*Used to add pointing error to gain calculations. Not related to pointing and rotational tolerances on records 5-2 and 5-4.

&All blank or zeros (for numeric data) fields will default to the value set at the scenario level. To override a non-zero value to a zero, you must use the smallest non-zero value that will fit in the field.

++Must correspond to Columns 1-8 of Record 1 of this file.

Control Overrid
Scenario Card 1
(Optional)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
34-41		15	Rain-atten-pct-worst-month	PIC F(8)	Limits are .054 to 2.93. Used for rain attenuation calculations.
		15	Protection-ratio-set-data		Protection ratio templates
42-45		20	Downpath-protection-set-key	PIC XXXX	
46-49		20	Feederlink-protection-ratio-key	PIC XXXX	
50-53		20	Total-protection-ratio-set-key	PIC XXXX	
54-57		20	Downpath-PR-zero	PIC 99.9	dB Co-channel Pro ratio
58-61		20	Feederlink-PR-zero	PIC 99.9	dB Co-channel Pro ratio
62-65		20	Total-PR-zero	PIC 99.9	dB Co-channel Pro ratio
66-80	05 Filler			PIC X(15)	

Control Overrides
Scenario Card 2
(Optional)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
	01	&Scenario-Record-2-Override			
1-8		&&05	Scenario-key		PIC X(8)
9		05	Cardtype	PIC 9	=2(Scenario)
		05+	Channelization-scheme-defaults		For selection of channelzation scheme
10-13			10 Downpath-chnlztn-scheme	PIC XXXX	
14-17			10 Uppath-chnlztn-scheme	PIC XXXX	
		05+	Point-data		
18			10 Rqmts-file-selection-option	PIC X	Source of points data Blank=Rqmts file R=Rqmts file P=Points file
19,20, ...,23			10* ESR-point-selection-code occurs 5	PIC X	Explained below (e.g., TP)
24,25,26			10** FLT-point-selection-code occurs 3	PIC X	Explained below (e.g., PM)
			For ESR- and FLT-point-selection-code, enter codes of point type codes to be selected: For ESR, any of: E=exterior B=boundary P=polygon (Box 6 B of Req. Form) I=interior T=test (Box 7 of Req. Form)		

All variables marked with a "+" can be overriden at the service area level.
*These codes will be used only for point sets labeled as down, no matter where they are being used.
**These codes will be used only for point sets labeled as up, no matter how they are being used.
&All blank or zeros (for numeric data) fields will default to the value set at the scenario level. To override a non-zero value to a zero, you must use the smallest non-zero value that will fit in the field.
&&Must correspond to Columns 1-8 of Record 1 of this file.

Control Overrid
Scenario Card 2
(Optional)

RECORD CHARS.	RECORD DESCRIPTION	FORMAT	COMMENT
	For FLT, any three of: I=Interior (Box 16 of Req. Form) F=Fixed M=Mobile T=Test (Box 13 of Req. Form) P=Polygon (Box 14 of Req. Form)		
	05+ Ellipse-file-data		
27-31	10* Ellipse-longitude-tolerance	PIC 99.99	degrees
32	10+ Ellipse-file-selection-option	PIC X	blank=Ellipse Fil E=Ellipse fil P=Parameter data
	05 Antenna-parameters-defaults		
	10 Downpath-antennas		
33-36	15+ Sat-tr-ant-charac-set-key	PIC XXXX	Satellite Transmit
37-40	15+ ESR-rcv-ant-charac-set-key	PIC XXXX	Earth Station Receive
41	15+ Down-ants-circ-or-linear-polarization flag	PIC X	(C,L) (Circular/ Linear)
42	15 Down-ants-aimpoint-or-subsat-pt-calc-flag	PIC X	(A,S) (aimpoint/ subsatellite poi
	10 Feederlink-antennas		
43-46	15+ FLT-tr-ant-charac-set-key	PIC XXXX	Feederlink Transm
47-50	15+ Sat-rcv-ant-charac-set-key	PIC XXXX	Satellite Receive
51	15+ Up-ants-cir-or-linear-polarization-flag	PIC X	(C,L) Circular/ Linear

*SOUP5 always picks the ellipse whose longitude is closest to the satellite longitude. Changing this value will not affect which ellipse is selected, unless the value is smaller than the longitude difference of the closest ellipse. In this case no ellipse will be selected and the user notified of this fatal error.

All variables marked with an "+" can be overridden at the service area level.

Control Overrides
Scenario Card 2
(Optional)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
52		**15	Up-ants-aimpoint-or subsat-pt-calc-flag	PIC X	(A,S) Aimpoint/ Subsatellite point
	05	Rain-attenuation-data			
53		10	Rain-attenuation-calc-flag	PIC X	C=Clear air R=rain attenuation
54-57		10	Max-allowed-rain-margin-uppath	PIC 99.9	dB; for power calculation
	05+	Satellite-transmitter-power-defaults			
58		10	EIRP-CN-PFD-or-power-flag	PIC X	(E,C,F,P) (How to compute/power)
59-64		10	Satellite-EIRP or	PIC S99.99	dBW, Flag = E
			ESR-CN or	PIC S999.9	dB, Flag = C
			ESR-PFD or	PIC S999.9	$dBW/_M2$, Flag = F
			Satellite-power	PIC 999.9	W, Flag = P
65-68		10	Max-adjustment	PIC 99.9	dB (Not used in SOUP)
	05+	Feederlink-transmitter-power-defaults			
69		10	EIRP-CN-PFD-or-power-flag	PIC X	(E,C,F,P)
70-75		10	FLT-EIRP or	PIC S99.99	dBW, Flag = E
			FLT-CN or	PIC S999.9	dB, Flag = C
			FLT-PFD or	PIC S999.9	$dBW/_M2$, Flag = F
			FLT-power	PIC 999.9	W, Flag = P
76-79		10	Max-adjustment	PIC 99.9	dB (Not used in SOUP)
80	05	Filler		PIC X	

**Needed only for linear polarization.
All variables marked with an "+" can be overridden at the service area level.

Control Overrid
Scenario Card 3
(Optional)

RECORD CHARS.	RECORD DESCRIPTION	FORMAT	COMMENT
	01 &Scenario-Record-3-Override.		
1-8	&&05 Scenario-key	PIC X(8)	Identifier
9	05 Cardtype	PIC 9	=3(Scenario)
	05 Output-data		
	10 Output-options		Yes or no
10	15 P3-Aggregate-report	PIC X	(Y,N) Summary
11	15 P3-Detail-report-1	PIC X	(Y,N) Single link
12	15 P3-Detail-report-2	PIC X	(Y,N) Single link
13	15 P3-Binary-output	PIC X	(Y,N) For post-processor
14	15 P2-Gain-table-graphs	PIC X	(Y,N) For checkin pattern
15,16,17,18,19	15 T.B.D.| occurs 5	PIC X	(Y,N) Not yet use
	10 Output-parameters		
20-24	*15 P3-Aggregate-report-margin-threshold-down-and-total	PIC 999.9	dB (Maximum value 300)**
25-29	*15 P3-Aggregate-report-margin-threshold-up	PIC 999.9	dB (Maximum value 300)**

*Only aggregate report lines of service areas whose aggregate margin is less than or equal to this value will be printed.

&All blank or zeros (for numeric data) fields will default to the value set at the scenario level. To override a non-zero value to a zero, you must use the smallest non-zero value that will fit in the field.
&&Must correspond to columns 1-8 of record 1 of this file.

All variables marked with an "+" can be overridden at the service area level.

Control Overrides
Scenario Card 3
(Optional)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
30-34		+15	P3-Detail-report-CI-threshold-down	PIC 999.9	dB (Maximum value 300)**
35-39		+15	P3-Detail-report-CI-threshold-up	PIC 999.9	dB (Maximum value 300)**
40-43		15	P2-Gain-Table-graph-phi-zero	PIC 99.9	degrees: must be greater than zero if used at all
44-58	05	Filler		PIC X(21)	
	05	Other-scenario-level-data			
59-61		&10	Maximum phi/phi0-for-Interference	PIC 9.9	No interference will be calculated when phi/phi0 of either antenna is greater than this value. If set to zero all interferences will be calculated.
62-63		&&10	Single-victim channel	PIC 99	If blank or zero process normally if not - calculate interference into this channel only
64		10	Inhibit-same-sat-adm-chanfam-interference	PIC X	(Y, N) If blank, 'N' is assumed
65-67		10	Number of service areas	PIC 999	- limit 300
68-73		10	Horizon	PIC F(6)	km distance over horizon Earth-Satellite link can still exist

+Only detail report lines of link equation results whose C/I is less than or equal to this value will be printed.

**Maximum value may depend on computer being used but in almost all cases should be greater than or equal to 300.

*If this has a value of 'Y' no interference will be calculated between service areas with same administration, same satellite longitude, and same channel family (for unblocked runs).

&&Must be blank or zero if Grouping flag (Col 75) is 'Y'. To override this field to 0, set to a negative value.

&To overide a positive value in the scenario file with a zero, use a negative number.

Control Overrid
Scenario Card 3
(Optional)

RECORD CHARS.		RECORD DESCRIPTION	FORMAT	COMMENT
74	++10	Nominal-frequency-option	PIC X	(L,M,H) L = use center frequency lowest channel, M median channel, H highest channel
75	&10	Grouping-in-effect-flag	PIC X	(Y,N)
76	05	Number-of-description-cards	PIC 9	(0-9)
77-78	05	Not Used - Must be blank		
79	05	Service-area-downpath-cards-present-flag	PIC X	(Y,N) yes/no
80	05	Service-area-feederlink-cards-present-flag	PIC X	(Y,N) yes/no

++Nominal frequency is the frequency used for all gain and attenuation calculations. Each channel family has its own nominal frequency.
&Must be 'N' if single-victim channel (cols 62-63) is non-blank.

Control Calculate-
Interference-Only-Into
Certain-Service-Areas

The next set of records allow the user to restrict the SOUP calculations to compute interference only into a designated set of service areas. If the user desires to calculate the interference into all the service areas, he may omit these records. If selected interference is desired, the three scenario override records, documented above, must exist at least as blank records. Up to a maximum of 3 records may be included here which will allow the user to designate up to 24 service areas for interference calculations, while excluding all others.

RECORD CHARS.			
	01 Calculation-service-areas (repeats 1 to 3 times)		
	05 Service-area (repeats as needed, up to 8 times)		
1-3,11-13,21-23 31-33,...71-73	10	Administration	PIC XXX
4-5,14-15,24-25, 34-35,...74-75	10	Area-designator	PIC XX
6-8,16-18,26-28, 36-38,...,76-78	10	Area-Type	PIC XXX

Note 1 - Stop-if-error-code-greater-than-value

Programs P1 and P2 perform various checks on the data which may detect errors of varying severity:

LEVEL	USAGE
20	Comments and warnings - e.g.: - invalid code values set to default values - violation of RARC parameters
21 and 22	Errors which may affect the processing or calculation of results downstream, but which generally can be processed.
23	Errors which will cause an abnormal halt in a subsequent program. Data required for a subsequent program have not been written.
97	Fatal error for Program 3, Program 1 and Program 2 may continue processing
98	Fatal error for Program 2, Program 1 may continue processing
99	Fatal errors. Read errors due to invalid data, premature file ends, data sequencing errors.

If an error detected by P1 or P2 has a severity greater than the value input on its control card, execution halts.

Program P3 does not use error severity logic.

Note 2 - Debug Print Switches

Program P2 and P3 have diagnostic prints at selected points controlled by the values of their respective print switches. (P1 uses swith logic to control output reports). If a switch is set to 1, the corresponding

diagnostic output appears in the program's diagnostic file at each execution of the code at the point. A detailed list of the data provided by each switch is provided in the Programmer's Manual.[5]

The output controlled by these switches is designed for the programmer and system analyst, not the user. In general, the user should set all these to 0 (or blank).

3.3 USE OF THE R2BCSAT-83 DATA BASE

Program P1 uses five input units for its data base. This division is done for processing efficiency, installation flexibility (some installations may not need all the files, and to allow the installation to give different files different levels of protection.

The five files are summarized below.

DATA.SCENARIO on unit IUSCEN (card image) - This file contains a set of records for each plan which can be analyzed. Each plan specifies all the satellite positions and provides to the technical parameters (such as point sets, ellipses, antennas, etc.) to use. This file is designed to be modified by the user. In most cases it is the only file the user needs to change.

DATA.PARAMS on unit IUPARM (card image)

This file contains technical parameters (i.e., antennas, point sets and ellipses). The installation will usually maintain an official version, but the user will have the option of maintaining his own private version in order to test new or modified parameters. The ellipses and the point sets in this file can be used to satisfy some or all of the scenario's requirements. In the latter case, the last three files below are not needed.

P3.IMATRX on unit P3.IMATRX

This file contains portions of the interference matrix which allows the user to inhibit interference calculations between selected service areas. The file can be produced by the synthesis program, or the user. If left empty all interference calculations will be done normally.

ELLIPSE - UP on unit IUELL1
ELLIPSE - DOWN on unit IUELL2

These files contain the official IFRB ellipses and are maintained by the IFRB. They are not designed to be modified by the user. If the user wants a non-official ellipse, it must be in DATA.PARAMS.

REQUIREMENTS on unit IUREQ

This file, maintained by the IFRB, contains all the information from the requirements forms developed for RARC-83. It is not designed to be modified by the user. SOUP5 can use it to obtain point set data and the location on the ellipse files of required ellipses. If the user wishes to use an unofficial point set, it can put on a private version of DATA.PARAMS.

3.3.1 DATA.SCENARIO - UNIT IUSCEN

DATA.SCENARIO contains sets of Scenario-plans. No special ordering of the scenarios on the file is necessary for PI to find and process the correct scenario specified in DATA.CONTROL. However, within a scenario, the order specified for the record types must be strictly followed. In addition, if service area grouping is in effect, the service areas which are grouped must be contiguous in the data.

Scenario Structure

The layout of a Scenario-plan is provided on the following pages, including allowable codes and units (e.g., dB). Inputs forms for the card-image scenario data are provided in Appendix A.

The data in a scenario are structured as follows:

- Scenario Level - applies to the run as a whole
  - Scenario description; optional
- Service Area (SA) Level - Repeats for each service area:
  - SA - applies to entire service area; required
  - SA/Downpath - applies to the Downpath of a service area; optional
  - SA/Feederlink - applies to the Feederlink of a service area; optional
  - Downpath point overrides; optional
  - Feederlink point overrides; optional

Conventions

- A non-blank value in an override field replaces the value assigned at a higher level.
- The various code fields such as Y(es) and N(o) usually have default values (for blank etc.) but some illegal values give fatal errors or warnings. If a warning is given then the

program goes on using a specified value as a default. This value is usually the same as the blank default if any, but this is not always the case.

The various keys point to data which are to be selected from the seven subfiles of the parameter file or the IFRB files

RARC
Channel Schemes
Protection Ratio Templates
Point Sets
Ellipses
Antennas
Gain Patterns
Requirements
Up Ellipses
Down Ellipses

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-1 - SCENARIO - These data apply to all service areas unless overridden at the service area level or again at the point level

RECORD CHARS.	RECORD DESCRIPTION	FORMAT	COMMENT
	01 Scenario-plan		
	03 Card-1		
1-8	05 Scenario-key	PIC X(8)	Identifier
9	05 Cardtype	PIC X	=1 (Scenario)
	05 RARC-parameter-data		
10-13	10 RARC-parameters-set-key	PIC XXXX	blank=use current official se
	10 RARC-parameter-overrides		(overrides RARC values if not blank)
	15 Antenna-and-beam parameters		
14-17	20+* [E-ant-pointing-tolerance]	PIC .999	fraction of beam-width: used for antenna off-axis angle calculation
18-21	20+* [S-ant-pointing tolerance]	PIC 9.99	degrees: used fo antenna off-axis angle calculation
22-25	20 [E-ant-rota-tional-tolerance]	PIC 9.99	degrees (not use in SOUP)

All variables marked with a "+" can be overridden at the service area level.

*Used to add pointing error to gain calculations. Not related to pointing and rotational tolerances on records 5-2 and 5-4.

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-1 - SCENARIO (Continued)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
26-29		20	[S-ant-rota-tional-tolerance]	PIC 9.99	degrees (not used in SOUP)
30-33		20+	[Delta-G-to-edge of beam]	PIC 9.99	dB
34-41		15	Rain-atten-pct-worst-month	PIC F(8)	Limits are .054 to 2.93. Used for rain attenuation calculations.
		15	Protection-ratio-set-data		Protection ratio templates
42-45		20	Downpath-protec-tion-set-key	PIC XXXX	
46-49		20	Feederlink-protec-tion-ratio-key	PIC XXXX	
50-53		20	Total-protec-tion-ratio-set-key	PIC XXXX	
54-57		20	Downpath-PR-zero	PIC 99.9	dB Co-channel Prot. ratio
58-61		20	Feederlink-PR-zero	PIC 99.9	dB Co-channel Prot. ratio
62-65		20	Total-PR-zero	PIC 99.9	dB Co-channel Prot. ratio
66-80	05 Filler			PIC X(15)	

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-2 - SCENARIO

These data apply to all service areas unless overridden at the service are level or again at the point level.

RECORD CHARS.	RECORD DESCRIPTION	FORMAT	COMMENT
	03 Card-2		Identifier
1-8	05 Scenario-key	PIC X(8)	
9	05 Cardtype	PIC 9	=2(Scenario)
	05+ Channelization-scheme-defaults		For selection of channelzation scheme
10-13	10 Downpath-chnlztn-scheme	PIC XXXX	
14-17	10 Uppath-chnlztn-scheme	PIC XXXX	
	05+ Point-data		
18	10 Rqmts-file-selection-option	PIC X	Source of points data Blank=Rqmts file R=Rqmts file P=Points file
19,20, ...,23	10* ESR-point-selection-code occurs 5	PIC X	Explained below (e.g., TP)
24,25,26	10** FLT-point-selection-code occurs 3	PIC X	Explained below (e.g., PM)

All variables marked with a "+" can be overriden at the service area level.

*These codes will be used only for point sets labeled as down, no matter where they are being used.

**These codes will be used only for point sets labeled as up, no matter how they are being used.

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-2 - SCENARIO (Continued)

RECORD CHARS.	RECORD DESCRIPTION	FORMAT	COMMENT
	For ESR- and FLT-point-selection-code, enter codes of point type codes to be selected: For ESR, any of: E=exterior B=boundary P=polygon (Box 6 B of Req. Form) I=interior T=test (Box 7 of Req. Form) For FLT, any three of: I=Interior (Box 16 of Req. Form) F=Fixed M=Mobile T=Test (Box 13 of Req. Form) P=Polygon (Box 14 of Req. Form)		
	05+ Ellipse-file-data		
27-31	10* Ellipse-longitude-tolerance	PIC 99.99	degrees
32	10+ Ellipse-file-selection-option	PIC X	blank=Ellipse File E=Ellipse file P=Parameter data
	05 Antenna-parameters-defaults		
	10 Downpath-antennas		
33-36	15+ Sat-tr-ant-charac-set-key	PIC XXXX	Satellite Transmit

All variables marked with a "+" can be overridden at the service area level.
*SOUP5 always picks the ellipse whose longitude is closest to the satellite longitude. Changing this value will not affect which ellipse is selected, unless the value is smaller than the longitude difference of the closest ellipse. In this case no ellipse will be selected and the user notified of this fatal error.

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-2 - SCENARIO (Continued)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
37-40		15+	ESR-rcv-ant-charac-set-key	PIC XXXX	Earth Station Receive
41		15+	Down-ants-circ-or-linear-polarization flag	PIC X	(C,L) (Circular/ Linear)
42		15	Down-ants-aimpoint-or-subsat-pt-calc-flag.	PIC X	(A,S) (aimpoint/ subsatellite poi
	10	Feederlink-antennas			
43-46		15+	FLT-tr-ant-charac-set-key	PIC XXXX	Feederlink Transm
47-50		15+	Sat-rcv-ant-charac-set-key	PIC XXXX	Satellite Receiv
51		15+	Up-ants-cir-or-linear-polarization-flag	PIC X	(C,L) Circular/ Linear
52		**15	Up-ants-aimpoint-or subsat-pt-calc-flag	PIC X	(A,S) Aimpoint/ Subsatellite poi
	05	Rain-attenuation-data			
53		10	Rain-attenuation-calc-flag	PIC X	C=Clear air R=rain attenuatio
54-57		10	Max-allowed-rain-margin-uppath	PIC 99.9	dB; for power calculation
	05+	Satellite-transmitter-power-defaults			
58		10	EIRP-CN-PFD-or-power-flag	PIC X	(E,C,F,P) (How to compute/power)

All variables marked with an "+" can be overridden at the service area level.

**Needed only for linear polarization.

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-2 - SCENARIO (Continued)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
59-64		10	Satellite-EIRP or	PIC S99.99	dBW, Flag = E
			ESR-CN or	PIC S999.9	dB, Flag = C
			ESR-PFD or	PIC S999.9	$dBW/_M2$, Flag = F
			Satellite-power	PIC 999.9	W, Flag = P
65-68		10	Max-adjustment	PIC 99.9	dB (Not used in SOUP)
	05+	Feederlink-transmitter-power-defaults			
69		10	EIRP-CN-PFD-or-power-flag	PIC X	(E,C,F,P)
70-75		10	FLT-EIRP or	PIC S99.99	dBW, Flag = E
			FLT-CN or	PIC S999.9	dB, Flag = C
			FLT-PFD or	PIC S999.9	$dBW/_M2$, Flag = F
			FLT-power	PIC 999.9	W, Flag = P
76-79		10	Max-adjustment	PIC 99.9	dB (Not used in SOUP)
80	05	Filler		PIC X	

+All variables marked with an "+" can be overridden at the service area level.

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-3 - SCENARIO

Report control and other data

RECORD CHARS.	RECORD DESCRIPTION	FORMAT	COMMENT
	03 Card-3		
1-8	05 Scenario-key	PIC X(8)	Identifier
9	05 Cardtype	PIC 9	=3(Scenario)
	&05 Output-data		
	10 Output-options		Yes or no
10	15 P3-Aggregate-report	PIC X	(Y,N) Summary
11	15 P3-Detail-report-1	PIC X	(Y,N) Single link
12	15 P3-Detail-report-2	PIC X	(Y,N) Single link
13	15 P3-Binary-output	PIC X	(Y,N) For post-processor
14	15 P2-Gain-table-graphs	PIC X	(Y,N) For checkin pattern
15,16,17,18,19	15 T.B.D.| occurs 5	PIC X	(Y,N) Not yet use
	10 Output-parameters		
20-24	*15 P3-Aggregate-report-margin-threshold-down-and-total	PIC 999.9	dB (Maximum value 300)**
25-29	*15 P3-Aggregate-report-margin-threshold-up	PIC 999.9	dB (Maximum value 300)**

*Only aggregate report lines of service areas whose aggregate margin is less than or equal to this value will be printed.
**Maximum value may depend on computer being used but in almost all cases should be greater than or equal to 300.
&Can be overridden on Record #1 of Data.Control

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-3 - SCENARIO (Continued)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
30-34		+15	P3-Detail-report-CI-threshold-down	PIC 999.9	dB (Maximum value 300)**
35-39		+15	P3-Detail-report-CI-threshold-up	PIC 999.9	dB (Maximum value 300)**
40-43		15	P2-Gain-Table-graph-phi-zero	PIC 99.9	degrees: must be greater than zero if used at all
44-58	05	Filler		PIC X(21)	
	05	Other-scenario-level-data			
59-61		&10	Maximum-phi/phi0-for-Interference	PIC 9.9	No interference will be calculated when phi/phi0 for either antenna is greater than this value. If set to 0 or blank, all interferences will be calculated.
62-63		&&10	Single-victim channel	PIC 99	If blank or zero process normally if not - calculate interference into this channel only
64		++10	Inhibit-same-sat-adm-chanfam-interference	PIC X	(Y, N) If blank, 'N' is assumed

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+Only detail report lines of link equation results whose C/I is less than or equal to this value will be printed.
*limit depends on version of program
**See note on previous page.
+If this has a value of 'Y' no interference will be calculated between service areas with same administration, same satellite longitude, and same channel family (for unblocked runs).
&&Must be blank or zero if Grouping flag (Col 75) is 'Y'.
&If set properly, this can save a large amount of computer time, without significantly affecting the results.

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-3 - SCENARIO (Continued)

RECORD CHARS.	RECORD DESCRIPTION		FORMAT	COMMENT
65-67	10	Number of service areas	PIC 999	- limit*
68-73	10	Horizon	PIC F(6)	km distance over horizon Earth-Satellite link ca still exist
74	++10	Nominal-frequency-option	PIC X	(L,M,H) L = use center frequency lowest channel, M median channel, H highest channel
75	&10	Grouping-in-effect-flag	PIC X	(Y,N)
76	05	Number-of-description-cards	PIC 9	(0-9)
77-78	05	Not Used - Must be blank		
79	05	Service-area-downpath-cards-present-flag	PIC X	(Y,N) yes/no
80	05	Service-area-feederlink-cards-present-flag	PIC X	(Y,N) yes/no

++Nominal frequency is the frequency used for all gain and attenuation calculations. Each channel family has its own nominal frequency.

&Must be 'N' if single-victim channel (cols 62-63) is non-blank.

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-4 - SCENARIO

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
	05	Scenario-description-card			
		* (repeating group, as many as needed - up to 9. Number set on column 76 of scenario card 3)			
1-8		10	Scenario-key	PIC X(8)	(Identifier)
9		10	Cardtype	PIC 9	=4
10		10	Card-number	PIC 9	=1,...,n(Description)
11-80		10	Description	PIC X(70)	For titles

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-5-1- SERVICE AREA - Defines an area

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
	05	Scenario-service-area * (repeating group)			Identifies area
	07	Service-area-card-1			
1-8		10	Scenario-key	PIC X(8)	As on card-1
9		10	Cardtype	PIC 9	=5 (Service Area)
		10	Service-area-key		
10-12			15 ITU-admin-abbrev	PIC XXX	(e.g., USA)
13-14			15 Area-designator	PIC XX	(e.g., ET)
15-17			15 Area-type	PIC XXX	(e.g., STC)
18		10	Subcardtype	PIC 9	=1 (Service Area)
19-22		10	Group-code	PIC XXXX	blanks = not grou ed; used only if grou ing flag = Y
23-80		10	Filler	PIC X(58)	ID (for title)

SCENARIO
SERVICE AREA
DOWNPATH
CARD 5-2

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-5-2 - SERVICE/DOWNPATH

RECORD CHARS.	RECORD DESCRIPTION	FORMAT	COMMENT
	07 Service-area-card-2		Downpath Data
1-8	10 Scenario-key	PIC X(8)	Identifier
9	10 Cardtype	PIC 9	=5 (Service Area)
	10 Service-area-key		
10-12	15 ITU-admin-abbrev	PIC XXX	
13-14	15 Area-designator	PIC XX	
15-17	15 Area-type	PIC XXX	
18	10 Subcard-type	PIC 9	=2 (Downpath)
	10 Downpath-data		
	15 Ellipse-key		pointer to ellipse in parameter or ellipse files
	20 Point-set-key		pointer to point set in parameter or requirement file
19	25 Up-down-flag*	PIC X	U=up ellipse and FLT pt-set D=down ellipse and ESR pt-set G=down ellipse and FLT pt-set H=up ellipse and ESR pt-set if blank, D is assumed

*This field determines whether the up or down point set and ellipse will be used. The ellipse and point set names are designated in columns 20-27 below.

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-5-2 - SERVICE/DOWNPATH (Continued)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
		25**	Point-set-ellipse service-area		if blank Service-area-key is used
20-22		30	ITU-admin-	PIC XXX	
23-24		30	Area-designator	PIC XX	
25-27		30	Area type	PIC XXX	
	20	Satellite-data-of-ellipse			
28-34		25	Satellite-longitude	PIC S999.99	degrees east; required field which is also used as the downpath satellit location. Ellips longitude must be within ellipse longitude tolerance of this.
35-38		25+	Pointing-error	PIC 9.99	degrees (used onl to find ellipse)
39-42		25+	Rotational-error	PIC 9.99	degrees (used onl to find ellipse)
43-47	15	Satellite-latitude		PIC S9.99	degrees: = 0. fo geosynchronous orbits

**If field is non-blank, the user will obtain the point set and beam (up or down, see note* above) belonging to the designated service area (Cols. 10-17).

+Not related to pointing tolerance and rotational tolerance on cards 1 and 5-3.

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-5-2 - SERVICE/DOWNPATH (Continued)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
48-49		15	Channel-family	PIC XX	character key
50-54		15	Polarization-angle	PIC S99.9	degrees if linear; if circular: +45= clockwise; -45 = counter-clockwise
55-80	10		Filler	PIC X(26)	

SCENARIO
SERVICE AREA
DOWNPATH
OVERRIDES
CARD 5-3

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-5-3 - SERVICE/DOWNPATH OVERRIDES (for service level data, zero or blank implies use scenario level values. This card must be included even if no overrides are wanted)

RECORD CHARS.	RECORD DESCRIPTION	FORMAT	COMMENT
	07 Service-area-card-3		
1-8	10 Scenario-key	PIC X(8)	Identifier
9	10 Cardtype	PIC 9	=5 (Service Area)
	10 Service-area-key		
10-12	15 ITU-admin-abbrev	PIC XXX	
13-14	15 Area-designator	PIC XX	
15-17	15 Area-type	PIC XXX	
18	10 Subcardtype	PIC 9	=3 (Downpath overrides)
	10 Downpath-data-continued		
	15 Override-data		
	20 Scenario-overrides		If non-blank or non-zero
19-22	*[25 E-ant-pointing-tolerance]	PIC .999	fraction of beam-width
23-26	*[25 S-ant-pointing-tolerance]	PIC 9.99	degrees

Note: Zero numeric values will not override scenario values; set to minimum possible in field length.

*Used to add pointing errors for gain calculations not related to pointing-error and rotational-error on card 5-2.

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-5-3 - SERVICE/DOWNPATH OVERRIDES (Continued)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
27-30		[25	Delta-G-to-edge of beam]	PIC 9.99	dB
31-34		25	Chnlztn-scheme-key	PIC XXXX	
35		[25	Rqmts-file-selection-option]	PIC X	R=Rqmts file P=Points file
36,37,38,39,40		*[25	Points-selection-code] occurs 5	PIC X	(see under Scenario Card-2)
41-45			Not Used	PIC X(5)	
46		[25	Ellipse-file-selection-option]	PIC X	E=Ellipse file P=Parameter file
47-50		[25	Sat-tr-ant-charac-set-key	PIC XXXX	
51-54		[25+	ESR-rcv-ant-charac-set-key	PIC XXXX	
55		[25	Down-ant-circ-or	PIC X	(C,L) Circular/linear

Note: Zero numeric values will not override scenario values; set to minimum possible in field length.

"+"=can be overridden at the point override level.

*This will be used only for point sets labeled as down, even if they are being used in up processing. If you are using an up point set for downpath processing, the override on Record 5-5 is used, (unless you do not have any down records - then you cannot override record 2)

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-5-3 - SERVICE/DOWNPATH OVERRIDES (Continued)

RECORD CHARS.	RECORD DESCRIPTION	FORMAT	COMMENT
	[25 linear-polarization-flag]		
	[25 Satellite-transmitter-power		
56	[30 EIRP-CN-PFD-or-power-flag]	PIC X +	(E,P) (E = EIRP, P = Power)
57-62	[30 Satellite-EIRP] or	PIC S99.99	dBW, Flag = E
	[ESR-CN] or	PIC S999.9	dB, Flag = C
	[ESR-PFD] or	PIC S999.9	$dBW/_M2$, Flag = F
	[Satellite-power]	PIC 999.9	Watts, Flag = P
63-66	[30 Max-adjustment]	PIC 99.9	dB (not used in SOUP)
67-68	15 Number-of-ESR-point-overrides	PIC 99	
69-80	10 Filler	PIC X(12)	

Note: Zero numeric values will not override scenario values; set to minimum possible in field length

\+ This should only be used when the service area power flag (or scenario level flag if, not overridden at service area level) is 'E' or 'P' otherwise a logical inconsistency will result, giving invalid power levels.

SCENARIO
SERVICE AREA
FEEDERLINK
CARD 5-4

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-5-4 - SERVICE/FEEDERLINK (Identical in format for card 5-2)

RECORD CHARS.	RECORD DESCRIPTION	FORMAT	COMMENT
	07 Service-area-card-4		
1-8	10 Scenario-key	PIC X(8)	Identifier
9	10 Cardtype	PIC 9	=5 (Service Area)
	10 Service-area-key		
10-12	15 ITU-admin-abbrev	PIC XXX	
13-14	15 Area-designator	PIC XX	
15-17	15 Area-type	PIC XXX	
18	10 Subcardtype	PIC 9	=4 (Feederlink)
	10 Feederlink-data		
	15 Ellipse		pointer to ellipse in parameter or ellipse file
	20 Point-set-key		pointer to point set in parameter or requirements file
19	25 Up-down-flag*	PIC X	U=up ellipse and FLT pt-set D=down ellipse and ESR pt-set G=down ellipse and FLT pt-set H=up ellipse and ESR pt-set

*This field determines whether the up or down point set and ellipse will be used. The ellipse and point set names are designated in columns 20-27 below.

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-5-4 - SERVICE/FEEDERLINK (Continued)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
					if blank, U is assumed
	25	Point-set-ellipse-** service-area			if blank, Service area-key is used
20-22		30	ITU-admin-abbrev	PIC XXX	
23-24		30	Area-desig-nator	PIC XX	
25-27		30	Area type	PIC XXX	
	20	Satellite-data-of-ellipse			along with point-set-and-beam
28-34		25	Satellite-longitude	PIC S999.99	degrees east; required field which is also used as the feede link satellite location. Ellip longitude must be within Ellipse-lo gitude tollerance of this.
35-38		25	+Pointing-error	PIC 9.99	degrees (used to find ellipse)
39-42		25	+Rotational-error	PIC 9.99	degrees (used to find ellipse)

+Not related to pointing tolerance and rotational tolerance on card 1 and 5-5.

**If field is non-blank, the user will obtain the point set and beam (up or down, see note * above) belonging to the designated service area.

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-5-4 - SERVICE/FEEDERLINK (Continued)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
43-47		15	Satellite-latitude	PIC S9.99	degrees: = for geosyn-chrouns orbits
48-49		15	Channel-family	PIC XX	character key
50-54		15	Polarization-angle	PIC S99.9	degrees if linear; if circular, +45=| clockwise, -45=| counter-clockwise
55-80	10	Filler		PIC X(26)	

SCENARIO
SERVICE AREA
FEEDERLINK
OVERRIDES
CARD 5-5

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-5-5 - SERVICE/FEEDERLINK OVERRIDES (Identical in format to card 5-3 - This card must be included even if no overrides are wanted)

RECORD CHARS.	RECORD DESCRIPTION	FORMAT	COMMENT
	07 Service-area-card-5		
1-8	10 Scenario-key	PIC X(8)	Identifier
9	10 Cardtype	PIC 9	=5 (Service Area)
	10 Service-area-key		
10-12	15 ITU-admin-abbrev	PIC XXX	
13-14	15 Area-designator	PIC XX	
15-17	15 Area-type	PIC XXX	
18	10 Subcardtype	PIC 9	=5 (Feederlink overrides)
	10 Feederlink-data-continued		
	15 Override-data		
	20 Scenario-overrides		
19-22	*[25 E-ant-pointing-tolerance]	PIC 9.99	fraction of beam-width
23-26	*[25 S-ant-pointing-tolerance]	PIC 9.99	degrees
27-30	[25 Delta-G-to-edge] of beam	PIC 9.99	dB

Note: Zero numeric values will not override scenario values; set to minimum possible in field length.

*Related to pointing error and rotational error on card 5-4.

SCENARIO
SERVICE AREA
FEEDERLINK
OVERRIDES
CARD 5-5 (Cont.)

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-5-5 - SERVICE/FEEDERLINK OVERRIDES (Continued)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
31-34		[25	Chnlztn-scheme-key	PIC XXXX	
35		[25	Rqmts-file-selection-option]	PIC X	R=Rqmts file P=Points file
36,37,38		*[25	Points-selection-code] occurs 3	PIC X	(see under Scenario Card-2)
39-40		25	Filler	PIC XX	
41-45		25	Not Used	PIC X(5)	
46		[25	Ellipse-file-selection-option]	PIC X	E=Ellipse file P=Parameter file
47-50		[25+	FLT-tr-ant-charac-set-key	PIC XXXX	
51-54		[25	Sat-rcv-ant-charac-set-key]	PIC XXXX	
55		[25	Up-ant-circ-or-linear-polarization flag]	PIC X	(C,L) (Circular/linear)
		25+	Feederlink-transmitter-power		

Note: Zero numeric values will not override scenario values; set to minimum possible in field length

"+" = Can be overridden at the point override level.

* This will be used only for point sets labeled as up, even if they are being used in down processing. If you are using a down point set for up processing, the override on record 5-3 is used (unless do not have any down records - in this case you cannot override record 2).

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-5-5 - SERVICE/FEEDERLINK OVERRIDES (Continued)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
56			[30 EIRP-CN-PFD-or-power-flag]	PIC X	(E,C,F,P) (E = EIRP, C = C/N, F = PFD, P = Power)
57-62			[30 FLT-EIRP	PIC S99.99	dBW, Flag = E
			or ESR-CN	PIC S999.9	dB, Flag = C
			or ESR-PFD	PIC S999.9	$dBW/_M2$, Flag = F
			or FLT-power]	PIC 999.9	Watts, Flag = P
63-66			[30 Max-adjust-ment]	PIC 99.9	dB (not used in SOUP)
67-68		15	Number-of-FLT-point-over-rides	PIC 99	
69-80	10	Filler		PIC X(12)	

Note: Zero numeric values will not override scenario values; set to minimum possible in field length

SCENARIO
SERVICE AREA
ESR-PT-OVERRIDE
CARD 5-6

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-5-6 - SCENARIO/ESR-PT-OVERRIDE (This record needed only if columns 67-68 of card 5-3 has non-zero value)

RECORD CHARS.	RECORD DESCRIPTION	FORMAT	COMMENT
	07 Service-Area-Card-6		
	10 ESR-points-override-data-card * (repeating group)		(as many as needed)
1-8	15 Scenario-key	PIC X(8)	Identifier
9	15 Cardtype	PIC 9	=5 (Service Area)
	15 Service-area-key		
10-12	20 ITU-admin-abbrev	PIC XXX	
13-14	20 Area-designator	PIC XX	
15-17	20 Area-type	PIC XXX	
18	15 Subcardtype	PIC 9	=6 (ESR pt. overrides)
19-20	15 Filler	PIC XX	
	15 ESR-point-data-overrides occur 6 times		
21-24,31-34,...,71-74	20 Point-number	PIC 9999	
25-28,35-38,...,75-78	[20 Antenna-charac-set-key]	PIC XXXX	Override for service area ESR antenna
29,39,...,79	[20 Rain-zone]	PIC X	override for point file data
30,40,...,80	20 Filler	PIC X	

SCENARIO
SERVICE AREA
FLT-PT-OVERRIDE
CARD 5-7

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-5-7 - SCENARIO/FLT-PT-OVERRIDE (This card needed only if columns 67-68 of card 5-5 has non-zero value)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
	07	Service-Area-Card-7			
		10	FLT-points-override-data-card *(repeating group)		(as many as neede
1-8		15	Scenario-key	PIC X(8)	Identifier
9		15	Cardtype	PIC 9	=5 (Service Area)
		15	Service-area-key		
10-12			20 ITU-admin-abbrev	PIC XXX	
13-14			20 Area-designator	PIC XX	
15-17			20 Area-type	PIC XXX	
18		15	Subcardtype	PIC 9	=7 (FLT pt. over-rides)
19-20		15	Filler	PIC XX	
		15	FLT-point-data-overrides occurs 3 times		
21-24,41-44,61-64			20 Point-number	PIC 9999	
25-28,45-48,65-68			[20 Antenna-charac-set-key]	PIC XXXX	Override for service area FLT antenna
29,49,69			[20 Rain-zone]	PIC X	Point override fo for point file data
			20 FLT-EIRP-CN-or-power		Feederlink data override

DATA BASE AREA: Scenarios (Plans)

FILE NAME: Scenario-plans

RECORD TYPE: CARD-5-7 - SCENARIO/FLT-PT-OVERRIDE (Continued)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
30,50,70		+[25	EIRP-CN-PFD-or-power-flag]	PIC X	(E,P) (E = EIRP P = Power)
31-36,51-56,71-76		[25	FLT-EIRP or	PIC S99.99	dBW, Flag = E
			FLT-power]	PIC 999.9	Watts, Flag = P
37-40,57-60,77-80	20	Filler		PIC X(4)	

+ This should only be used when the downpath service area power flag (or scenario level flag if, not overridden at service area level) is 'E' or 'P' otherwise a logical inconsistency will result, giving invalid power levels.

3.3.2 DATA.PARAMS - UNIT IUPARM

DATA.PARAMS contains all of the files from the R2BCSAT-83 data base used by the programs except the Scenario-plan file and the IFRB files. The files are the following, in the order that they must appear in DATA.PARAMS:

DATA BASE AREA	FILE NAME
Parameters	RARC parameters
Parameters	Channelizations
Parameters	Protection Ratio Sets
Parameters	Point Sets (Alternate for IFRB Requirements
Results	Ellipses (Alternate for IFRB Ellipse File)
Parameters	Antenna Characteristics
Parameters	Gain Tables

Each of the above files must be sorted in ascending, alphanumeric order according to the collating sequence of the computer system on which the programs are run*. (An installation-dependent subroutine, IC, may need to be rewritten to permit valid comparisons of alphanumeric data on some computers.) In addition each file must have as its last entry a Data-type Termination Record. The format of the record is:

Record Characters	Description			
	01	Data-type-Termination-card		
1-4	05	Termination-characters	PIC XXXX	= "****"
5-80	05	Filler	PIC X(76)	

The layout of each of the files included in DATA.PARAMS is provided on the following pages, including allowable codes and units (e.g., dB). Inputs forms for each of these files are provided in Appendix A.

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*The Point Set section is an exception to this. See footnote on page 3-63 for sorting instruction.

PARAMETERS
RARC
CARD 1

DATA BASE AREA: Technical Parameters

FILE NAME: RARC-parameters

RECORD TYPE: RARC-PARAMETER-SET

RECORD CHARS.	RECORD DESCRIPTION	FORMAT	COMMENT
	01 RARC-parameter-set		Basic Planning Facts
	03 Card-1		
1-4	05 RARC-parameters-set-key	PIC XXXX	ID (for selection)
5	05 Cardtype	PIC 9	=1
6	05 Current-official-flag	PIC X	(Y,N) (yes/no)
	05 Antenna-and-beam-parameters		
7-11	10 +Min-S-ant-beamwidth	PIC 99.99	degrees:
12-15	10 *Max-S-ant-axial-ratio	PIC 9.99	Not used in SOUP
16-19	10 Min-FL-ant-diameter	PIC 9.99	meters; for gain-type 4 calculations only must be greater than.
	10+ Tolerances		for worst case calculations
20-23	15 E-ant-pointing-tolerance	PIC .999	fraction of beamwidth
24-27	15 S-ant-pointing-tolerance	PIC 9.99	degrees
28-31	15 E-ant-rotational-tolerance	PIC 9.99	degrees (not used in SOUP)

All variables marked with a "+" can be overridden by the scenario data.
*These parameters are meant to be used by the ellipse generation program.
†For satellite transmit antennas. Satellite receive antennas use this mumber multiplied by (12.5/17.5)

DATA BASE AREA: Technical Parameters

FILE NAME: RARC-parameters

RECORD TYPE: RARC-PARAMETER-SET (Continued)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
32-35		15	S-ant-rotational-tolerance	PIC 9.99	degrees (not us in SOUP
36-39		10+	Delta-G-to-edge-of-beam	PIC 9.99	dB
40-80	05	Comment		PIC X(41)	ID (for title)
	03	Card-2			
1-4	05	RARC-parameters-set-key		PIC XXXX	Identifier
5	05	Cardtype		PIC 9	=2
	05	Channelization-parameters+			(guard bands)
6-11		10	Uppath-lower-bandedge-freq	PIC 99.999	GHz
12-17		10	Uppath-upper-bandedge-freq	PIC 99.999	GHz
18-22		10	Uppath-lower-guardband-width	PIC 99.99	MHz
23-27		10	Uppath-upper-guardband-width	PIC 99.99	MHz
28-33		10	Downpath-lower-bandedge-freq	PIC 99.999	GHz
34-39		10	Downpath-upper-bandedge-freq	PIC 99.999	GHz
40-44		10	Downpath-lower-guard-band-width	PIC 99.99	MHz

+See Appendix G.

DATA BASE AREA: Technical Parameters

FILE NAME: RARC-parameters

RECORD TYPE: RARC-PARAMETER-SET (Continued)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
45-49		10	Downpath-upper-guard-band-width	PIC 99.99	MHz
50-53		10	Bandwidth-coefficient (not used)	PIC 9.99	Not used in SOUP
54-80	05	Filler		PIC X(27)	
	03	Card-3			
1-4	05	RARC-parameters-set-key		PIC XXXX	Identifier
5	05	Cardtype		PIC 9	=3
	05	Rain-attenuation-parameters			
6-9		10	Max-allowed-rain-margin-downpath	PIC 99.9	dB; for power calculations only
10-17		10+	Percent-of-worst-month	PIC F(8)	Limits .054 to 2.93
	05	Protection-ratio-data			
		10+	Protection-ratio-set-keys		pointer to protection Ratio templates
18-21			15 Downpath-protection-ratio-set-key	PIC XXXX	
22-25			15 Feederlink-protection-ratio-set-key	PIC XXXX	

All data marked with a "+" can be overridden by the scenario data

DATA BASE AREA: Technical Parameters

FILE NAME: RARC-parameters

RECORD TYPE: RARC-PARAMETER-SET (Continued)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
26-29		15	Total-protection-ratio-set-key	PIC XXXX	
	10+	Co-channel-protection-ratios			(PR_0's)
30-33		15	Downpath-PR-zero	PIC 99.9	dB
34-37		15	Feederlink-PR-zero	PIC 99.9	dB
38-41		15	Total-PR-zero	PIC 99.9	dB
42-45	05	FLT-noise-contribution		PIC 9.99	dB (not used)
46-51	05	Overall-CN		PIC S999.9	dB (not used)
52,53,...,78	05	Official-parameter-flag occurs 27 times		PIC X	(Y,N) (not used)
79-80	05	Filler		PIC XX	

DATA BASE AREA: Technical Parameters

FILE NAME: Channelizations

RECORD TYPE: CHANNELIZATION

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
	01	Channelization+			
		03	Card-1		
1-4		05	Channelization-key	PIC XXXX	ID (for selection)
5		05	Cardtype	PIC 9	=1
6		05	Uppath-or-downpath-flag	PIC X	(U,D)
7-13		05	Lowest-center-frequency	PIC 999.999	GHz
14-15		05	No-of-channels	PIC 99	(e.g., 36)
16-20		05	Channel-bandwidth	PIC 99.99	MHz (for nominal frequency and guard band calculations)
21-25		05	Channel-separation	PIC 99.99	MHz (for nominal frequency and guard band calculations)
26-30		05	Channel-noise-bandwidth	PIC 99.99	MHz (for C/N calculation) Must be greater than
31-35		05*	Top-baseband-frequency	PIC 99.99	MHz Must be greater than 0.
36-40		05*	Peak-to-peak-deviation	PIC 99.99	MHz Must be greater than 0.
41		05	Official-flag	PIC X	(Y,N) (yes/no)

*Used to calculate the Carson's Rule bandwidth which is used for protection ratio calculation. (See Appendix F).

+See Appendix G for a graphic illustration of channelization.

DATA BASE AREA: Technical Parameters

FILE NAME: Channelizations

RECORD TYPE: CHANNELIZATION (Continued)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
42-43		05	Number-of-channel-families	PIC 99	which follow
44-80		05	Comment	PIC X(37)	ID (for title)

DATA BASE AREA: Technical Parameters

FILE NAME: Channelizations

RECORD TYPE: CHANNEL FAMILY

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
	05	Channel-family *(repeating-group)+			
	07	Channel-family-card-1			
1-4		10	Channelization-key	PIC XXXX	Identifier
5		10	Cardtype	PIC 9	=2
6-7		10	Channel-family-key	PIC XX	(e.g., 'AA' or '01')
8		10	Cardno-in-channel-family	PIC 9	=1
9-10		10	No-of-channels-in-family	PIC 99	(e.g., 4)
11-12,13-14,...,79-80		10	Channel occurs 35 times	PIC 99	e.g., (01050913)
	07	Channel-family-following-card *(repeating group) only if more than 35 channels in the family			
1-4		10	Channelization-key	PIC XXXX	
5		10	Cardtype	PIC 9	=2
6-7		10	Channel-family-key	PIC XX	
8		10	Cardno-in-channel-family	PIC 9	=2,...,n
9-10		10	Filler	PIC XX	
11-12,13-14,...,79-80		10	Channel occurs 35 times	PIC 99	

+Appendix G for further explanation of channelization.

DATA BASE AREA: Technical Parameters

FILE NAME: Protection-ratio-template

RECORD TYPE: PROTECTION-RATIO-TEMPLATE

Per Doc. A/88-E

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
	01	Protection-ratio-template			
	03	First-card-for-template			
1-4	05	Protection-ratio-key		PIC XXXX	ID (for selection
5	05	Card-number		PIC 9	=1
6-7	05	Number-of-segments		PIC 99	(e.g., 3)
8	05	Filler		PIC X	
	05	Segment occurs 2 times			
9-16,41-48	10		Upper-limit-frequency-difference	PIC F(8)	limit of normaliz frequency differ- ence for use of this segment
17-24,49-56	10		Segment-value-at-offset	PIC F(8)	dB see below
25-32,57-64	10		Slope	PIC F(8)	dB
33-40,65-72	10		Offset*	PIC F(8)	

Where protection ratio is computed as a function of normalized frequency difference (FD) using the formula Segment-value-at-offset + Slope * (FD-Offset). Normalized frequency is frequency divided by Carson's rule bandwidth (Carson's rule bandwidth = Peak-to-peak deviation + 2 times Top-baseband-frequency).

	03	Following-card-for-same-template			(if more than 2 segments)
1-4	05	Protection-ratio-key		PIC XXXX	Identifier

*The offset is a point on the segment (arbitrarily selected) whose value (segment-value-at-offset) is easy to find.

DATA BASE AREA: Technical Parameters

FILE NAME: Protection-ratio-template

RECORD TYPE: PROTECTION-RATIO-TEMPLATE (Continued)

Per Doc. A/88-E

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
5	05	Card-number-in-template		PIC 9	=2,...,as many as needed
6-8	05	Filler		PIC XXX	
	05	Segment occurs 2 times			
9-16,41-48		10	Upper limit	PIC F(8)	(leave blank for last segment)
17-24,49-56		10	Segment-value-at-offset	PIC F(8)	dB
25-32,57-64		10	Slope	PIC F(8)	dB
33-40,65-72		10	Offset*	PIC F(8)	

*See note on previous page.

PARAMETERS
POINT SET

DATA BASE AREA: Technical Parameters

FILE NAME: Point sets (Alternate for Requirements File)

RECORD TYPE: POINT-SET

RECORD CHARS.	RECORD DESCRIPTION	FORMAT	COMMENT
	01 Point-set		
	03 Card-1		
1-4	05 Point-set-key (not used)	PIC XXXX	First four characters of service area key
5	05 Cardtype	PIC 9	=1
	05 Service-area-key		
6-8	10 ITU-adm-abbrev	PIC XXX	e.g., USA
9-10	10 Area-designator	PIC XX	e.g., EA for eastern
11-13	10 Area-type	PIC XXX	e.g., STZ for standard time zone
14	05 Up-or-down-flag	PIC X	U (up) means FLT D (down) means ESR
15	05 Official-set-flag	PIC X	(Y,N) (yes/no)
16	05 Default-rain-zone	PIC X	if not specified for a point (A,B,C,D,E,F,G,H, K,L,M,N,P)
17-18	05 Number-of-points	PIC 99	
19-80	05 Comment	PIC X(62)	ID (for title)

Note: The point set section of technical parameters must be sorted by appending Up-or-down-flag followed by the service-area-key to beginning of each record, sortin on these 9 bytes plus card type (col 5) and 1st point number (col 6-9), and then deleting the appended nine characters.

*Point data may also be obtained from the requirement file which is maintained by the IFRB. (See below)

DATA BASE AREA: Technical Parameters

FILE NAME: Point sets

RECORD TYPE: POINT-SET POINTS

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
	05	Card-2 * (repeating group)			points card
1-4		10	Point-set-key	PIC XXXX	Identifier
5		10	Cardtype	PIC 9	=2 (points card)
		10	Point occurs 3 times		
6-9,31-34,56-59			15 Point-number	PIC 9999	
			15 Point-location-data		
10,35,60			20 Point-type	PIC X	if FLT: P=polygon, F=fixed, M=Mobile. If T=Test I=interior ESR: T=test I=interior P=polygon, E=exterior, I=interior, B=boundary.
11-16,36-41,61-66			20 Point-latitude	PIC S99.99	degrees north
17-23,42-48,67-73			20 Point-longitude	PIC S999.99	degrees east
24-28,49-53,74-78			15 Point-elevation	PIC S9999	meters above sea level
29,54,79			15 Point-rain-zone	PIC X	(A,B,C,D,E,F,G,H,J, K,L,M,N,P)
30,55,80			15 Filler	PIC X	

Note: See sorting instructions on previous page.

PARAMETERS
BEAM

DATA BASE AREA: Results

FILE NAME: *Ellipse (Alternate for IFRB Ellipse File)

RECORD TYPE: ELLIPSE

RECORD CHARS.	RECORD DESCRIPTION	FORMAT	COMMENT
	01 Ellipse		Generic ellipse for beam
	05 Ellipse-key		
1	10 Up-down flag	PIC X	(U, D)
	10 Ellipse service area		
2-4	15 ITU-admin-abbrev	PIC XXX	
5-6	15 Area-designator	PIC XXX	
7-9	15 Area-type	PIC XX	
	10 Satellite-data		
10-15	15 Satellite-longitude	PIC S999.9	degrees east
16-19	15 Pointing-error	PIC 9.99	degree
20-23	15 Rotational-error	PIC 9.99	degrees
	05 Ellipse-parameters		
24-29	10 Aimpoint-latitude	PIC S99.99	degrees (on Earth
30-36	10 Aimpoint-longitude	PIC S999.99	degrees (on Earth

Note: The Ellipse File must be sorted in the following order:

Key	Cols	Field-Type
1	1-9	Character
2	16-19	Real
3	20-23	Real
4	10-15	Real

*Ellipse data may also be obtained from the Ellipse file maintained by the IFRB documented below.

DATA BASE AREA: Results

FILE NAME: Ellipse

RECORD TYPE: ELLIPSE (Continued)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
	10	Orientation-angle-of-major-axis			(only flag if beam is circular)
37		15	Orient-or-ref-flag	PIC X	(O,R;C= circular) (O = orientation angle R = Reference Point*, C = Circular)
38-44		15	Orientation-angle or	PIC S999.99	degrees
			Ref-point-latitude*	PIC S99.99	degrees north
45-51		15	Ref-point-longitude*	PIC S999.99	degrees east
52-56	10	Major-axis		PIC 99.99	degrees
57-61	10	Minor-axis		PIC 99.99	degrees
62	05	Official-flag		PIC X	(Y,N); Yes only if all inputs are official
63-80	05	Comment		PIC X(18)	ID (for title)

*The reference point is the latitude and longitude of the projection of any point of the ellipse major axis (except the aimpoint) on the Earth's surface.

DATA BASE AREA: Technical Parameters

FILE NAME: Antenna-characteristics

RECORD TYPE: ANTENNA-CHARACTERISTIC-SET

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
	01	Antenna-characteristics-set			
1-4	05	Antenna-charac-set-key		PIC XXXX	ID (for selection
5	05	Earth-or-space-flag		PIC X	(E,S) (Earth/Spac
6	05	Tr-or-Rc-flag		PIC X	(T,R) (Transmit/-Receive)
	05	E-ant-diam-or-coverage-angle-data (earth antennas only)			
7		10	Diameter-or-coverage-angle-flag	PIC X	(D,C) Diameter/ Coverage angle
8-12		10	Diameter or Coverage-angle	PIC 99.99 PIC 99.99	meters degrees
13-16	05	Aperture-efficiency		PIC 9.99	EAP
	05	Merit-or-noise-data (receiving antennas only)			
17		10	Merit-or-noise-flag	PIC X	(M,N) (Merit/Noi
18-23		10	Figure-of-merit or Receiver-noise-temperature	PIC S99.99 PIC 9999.	dB/K K
24-27	05	Gain-table-copolarized-key		PIC XXXX	Key of co-pol pattern
28-31	05	Gain-table-xpolarized-key		PIC XXXX	Key of x-pol pattern
32	05	Official-flag		PIC X	(Y,N) (yes/no)
33-80	05	Comment		PIC X(48)	ID (for title)

DATA BASE AREA: Technical Parameters

FILE NAME: Gain-pattern-tables

RECORD TYPE: Gain-pattern-tables (Used to compute off-axis gains of antennas)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
	01	Gain-pattern-table			
1-4		05	Gain-table-key	PIC XXXX	ID (for selection)
5		05	Cardtype	PIC 9	=1
6-7		05	*Gain-pattern-type	PIC 99	see codes for current types at end of this subsection
8-9		[05	Gain-calculation-option-] flag	PIC 99	for future use not used now
10-12		05	+Number-of-cards-for-table	PIC 999	including this car
13-80		05	Table-description	PIC X(68)	ID (for title)

---

*SOUP5 now supports 5 types
Type 1 - segmented function
Type 2 - segmented function (older version, obsolete - do not use)
Type 3 - 1982 satellite fast-rolloff (obsolete - do not use)
Type 4 - CPM Feederlink transmit
Type 5 - 1983 - RARC Satellite fast rolloff
Types 1 & 2 use segmented function table (see page 3-70),
3, 4, & 5 use arbitrary gain function table (page 3-74)

+For segmented-function-table (Types 1 & 2)
Number-of-segments + 1
For Type 3, 3
For Type 4 & 5, 2

PARAMETERS
GAIN-PATTERN
SEGMENTED FUNCT
TABLE

DATA BASE AREA: Technical Parameters

FILE NAME: Gain-pattern-tables

RECORD TYPE: Segmented-function-table (for off-axis gain as a segmented function of off-axis angle and beamwidth)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
	05	Segmented-function-table			
	10	Segment * (repeating group)			
1-4		15	Gain-table-key	PIC XXXX	
5		15	Cardtype	PIC 9	=2
6		15	Segment-sequence	PIC X	=A,B,...
7		15	Card-sequence-in-segment-code	PIC X	=A
8-15		15	Upper-segment-limit	PIC F(8)	degrees or angl ratio; (dependi on column 18 below)
16-17		15	Segment-equation-type	PIC 99	see end of subsection
18		15	Segment-limit-equation-type-flag	PIC X	P = phi (off-ax angle) Z = Phi/phi-zer (phi-zero is be width correcte ellipse orienta tion)
19-20		15	Number-of-coefficients	PIC 99	
21-30,31-40, ...,71-80		15	Coefficient-for-equation occurs 6 times	PIC F(10)	units will var; depending on e tion type
		15	Following-card-for-same-segment*	(RG)	as many as nee for coefficien

DATA BASE AREA: Technical Parameters

FILE NAME: Gain-pattern-tables

RECORD TYPE: Segmented-function-table (Continued)

RECORD CHARS.	RECORD DESCRIPTION		FORMAT	COMMENT
1-4	20	Gain-table-key	PIC XXXX	
5	20	Cardtype	PIC 9	=2
6	20	Segment-sequence-code	PIC X	=A,B,...
7	20	Card-sequence-in-segment-code	PIC X	=B,C,...
8-20	20	Filler	PIC X(13)	
21-30,31-40,71-80	20	Coefficient-for-equation occurs 6 times	PIC F(10)	units will vary C_1, C_2 ... C_6

DATA BASE AREA: Technical Parameters

FILE NAME: Gain-pattern-tables

RECORD TYPE: COORDINATE-TABLE

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
	05	Coordinate-table redefines Segmented-function-table (not yet implemented)			
	07	Second-card-for-table			
1-4	10	Gain-table-key		PIC XXXX	
5	10	Cardtype		PIC 9	=2
6-7	10	Number-of-fixed-parameters		PIC 99	
8-10	10	Number-of-coordinate-sets		PIC 999	
11-16	10	Filler		PIC X(6)	
17-24,25-32 ...,73-80	10	Fixed-parameter occurs 8		PIC F(8)	units will vary
	07	Coordinates-card *(repeating group)			
1-4	10	Gain-table-key		PIC XXXX	
5	10	Cardtype		PIC 9	=4
6-8	10	Card-number		PIC 999	=1,...,number of cards for this table
	10	Coordinate-data occurs 3 times			
		15	Earth-coordinates-gain		
9-14,33-38,57-62		20	Earth-longitude	PIC S99.99	degrees
15-21,39-45,63-69		20	Earth-latitude	PIC S999.99	degrees
22-27,46-51,70-75		20	Gain	PIC S99.99	dB
28-32,52-56,76-80		20	Filler	PIC X(5)	

DATA BASE AREA: Technical Parameters

FILE NAME: Gain-pattern-tables

RECORD TYPE: Coordinate-Table (Continued)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
	15	Satellite-coordinates-gain redefines Earth-coordinates-gain			
9-14,33-38,57-62		20	Off-axis-angle	PIC S99.99	degrees
15-21,39-45,63-79		20	Orientation-angle	PIC S999.99	degrees
22-27,46-51,70-75		20	Gain	PIC S99.99	dB
28-32,52-56,76-80	15	Filler		PIC X(5)	

DATA BASE AREA: Technical Parameters

FILE NAME: Gain-pattern-tables

RECORD TYPE: Arbitrary-gain-functions-table (for off-axis gain as a function of various parameters) Currently used for pattern types 4 and 5.

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
	05	Arbitrary-gain-functions-table redefines Segmented-function-table			
	07	Second-card-for-table			
1-4		10	Gain-table-key	PIC XXXX	
5		10	Cardtype	PIC 9	=2
6-7		10	Card-number-for-table	PIC 99	=1
8-10		10	Number-of-parameters	PIC 999	
11-20,21-30, ...,71-80		10	Parameter occurs 7 times	PIC F(10)	units will vary C_1, C_2 ... C_7
	07	Following-card-for-table * (repeating group)			if more than 7 parameters are needed
1-4		10	Gain-table-key	PIC XXXX	
5		10	Cardtype	PIC 9	=3
6-7		10	Card-number-for-table	PIC 99	=2,...,n
8-10		10	Filler	PIC XXX	
11-20,21-30, ...,71-80		10	Parameter occurs 7 times	PIC F(10)	units will vary C_8, C_9 ... C_{14}; C_{15} ... C_{21} etc

DATA BASE AREA: Technical Parameters

FILE NAME: Gain-pattern-tables

RECORD TYPE: Parameterized-grid-gain-table

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
	05	Parameterized-grid-gains-table redefines Segmented-function-table (not yet implemented)			
	07	Second-card-for-table			
1-4		10	Gain-table-key	PIC XXXX	
5		10	Cardtype	PIC 9	=2
6-7		10	Number-of-fixed-parameters	PIC 99	
8-10		10	Number-of-repeating-parameters	PIC 999	
11-20,21-30, ...,71-80		10	Fixed-parameters occurs 7	PIC F(10)	units will vary;
	07	Following-fixed-parameter-card * (repeating group)			
1-4		10	Gain-table-key	PIC XXXX	
5		10	Cardtype	PIC 9	=3
6-7		10	Card-number	PIC 99	=2,...,n
8-10		10	Filler	PIC XXX	
11-20,21-30, ...,71-80		10	Fixed-parameters occurs 7 times	PIC F(10)	units will vary

PARAMETER
GAIN-PATTERN
PARAMETERIZED
GRID GAIN

DATA BASE AREA: Technical Parameters

FILE NAME: Gain-pattern-tables

RECORD TYPE: Parameterized-grid-gain-table (Continued)

RECORD CHARS.	RECORD DESCRIPTION			FORMAT	COMMENT
	07	Repeating-parameter-card * (repeating group)			
1-4		10	Gain-table-key	PIC XXXX	
5		10	Cardtype	PIC 9	=4
6-7		10	Card-number	PIC 99	=1,...,n
8-10		10	Filler	PIC XXX	
11-20,21-30, ...,71-80		10	Repeating-parameter occurs 7 times	PIC F(10)	units will vary; often used for gain values

CODE TRANSLATIONS

Gain-pattern-type

VALUE	DESCRIPTION	TABLE TYPE USED
01	Segmented curves based on ϕ/ϕ_0 or 0_0	Segmented-function table
03	No longer used, superceeded by type 5	Arbitrary-gain-function-table
04	CCIR 1982 Feederlink transmit antenna	Arbitrary - gain-function-table
05	RARC 83 fast rolloff satellite antenna	Arbitrary-gain function-table

GAIN PATTERN DISCUSSION

Type 1 - Segmented gain pattern

Type 2 - A special case of type 1 (not supported now)

Type 3 - 1982 Fast rolloff satellite antenna. Obsolete do not use; use type 5

Type 4 - 1982 CPM Feederlink Transmit Antenna

Type 5 - 1983 RARC Fast rolloff satellite antenna

Type 1 allows the user to define f, fall off in gain (dB), as a composite of any number of segments. The values of ϕ or ϕ_a (defined below) delineating the segment boundaries are read from the gain entry table section of the data base. The value of f in each segment is defined by one of five user designated functions. The segments can be used in any order.

1) $f = C_1$ IV-C2

2) $f = C_1 * (\phi_a - C_2)^{C_3}$ IV-C3

3) $f = C_1 + C_2 \log (C_3 * (\phi_a - C_4))$ IV-C4

4) $f = C_1 + 10 * \log (G_{oa}) + C_2 \log (\phi) + C_3 \phi^2$ IV-C5

5) $F = C_1 + C_2 \phi_a^{\,2} + C_3 \phi_a^{\,4} + \ldots . C_n \phi_a^{\,2n}$ IV-C6

$f = -10 \log F$

where ϕ = off axis angle in degrees

ϕ_z = antenna beamwidth (corrected for ellipse orientation if antenna is elliptical)

$\phi_a = \phi / \phi_z$

n (the number of coefficients) and the coefficients $C_1 \ldots C_n$ are taken from the database's gain entry table section.

For each segment, the user specifies the segment limit, whether the limit is on ϕ, or ϕ_a, the segment equation type (1 to 5) and the values of the C_n's.

Type 2 - no longer exists

Type 3, generic 1982 fast roll-off (no longer used, use Type 5 instead).

Type 4, the CPM generic 82 Feederlink Transmit antenna it uses a parameter, D_{min} (minimum antenna diameter in meters), which is entered on the RARC parameter section of the parameters file. The equation has four segments which are functions of ϕ, ϕ_a and V

where $V = D/D_{min}$

and D is the antenna diameter in meters.

Type 5, 1983 RARC Satellite Fast Roll-off has segment boundaries which are functions of ΔG (the dB gain fall-off at the ellipse boundary -- an input parameter) and ϕ_a, which is a function of ϕ_z.

The equations for Types 3, 4 and 5 are on the following pages.

Arbitrary-gain-function table for Fast Roll-Off (Pattern Type 3)

Let $G(\phi) = GOA - f$

f = fall-off in dB from on-axis gain;

GOA = on-axis gain (dB)

$$x = \sqrt{\frac{\Delta G_3}{12}}\left(1 - \frac{c_2}{\phi_0}\right)$$

ΔG_3 = maximum of (3, ΔG) where
ΔG is the gain fall-off at ellipse edge (dB)

Equation	Limits	Description
$f = 12\left(\frac{\phi}{\phi_0}\right)^2$	$0 \leq \frac{\phi}{\phi_0} \leq \sqrt{\frac{\Delta G_3}{12}}$	Gaussian
$f = 12\left(\frac{\phi_0}{c_2}\right)^2\left(\frac{\phi}{\phi_0} - x\right)^2$	$\sqrt{\frac{\Delta G_3}{12}} < \frac{\phi}{\phi_0} \leq \frac{c_2}{\phi_0}\sqrt{\frac{c_3}{12}} + x$	Fast roll-off
$f = c_3$	$\frac{c_2}{\phi_0}\sqrt{\frac{c_3}{12}} < \frac{\phi}{\phi_0} - x \leq \frac{c_2}{\phi_0}\,10^{\left(\frac{c_3 - c_4}{c_5}\right)}$	Plateau
$f = c_4 + c_5 \log_{10}\left[\frac{\phi_0}{c_2}\left(\frac{\phi}{\phi_0} - x\right)\right]$	$\frac{c_2}{\phi_0}\,10^{\left(\frac{c_3 - c_4}{c_5}\right)} < \frac{\phi}{\phi_0} - x \leq \frac{c_2}{\phi_0}\,10^{\left(\frac{c_6 - c_4}{c_5}\right)}$	Beamlet roll-off
$f = c_6$	$\frac{c_2}{\phi_0}\,10^{\left(\frac{c_6 - c_4}{c_5}\right)} < \frac{\phi}{\phi_0} - x \leq \frac{c_2}{\phi_0}\,10^{\left(\frac{c_6 - c_7}{c_8}\right)}$	Plateau
$f = c_7 + c_8 \log_{10}\left(\frac{\phi_0}{c_2}\left(\frac{\phi}{\phi_0} - x\right)\right)$	$\frac{c_2}{\phi_0}\,10^{\left(\frac{c_6 - c_7}{c_8}\right)} < \frac{\phi}{\phi_0} - x$	Beamlet roll-off
$G(\phi) = c_9$	$G(0) = GOA \times F < c_9$	Lower limit

Arbitrary-Gain-Function Table For CPM Feederlink Transmit (Type-4)

$V = D/D_{min}$; where D is antenna diameter in meters

D_{min} is minimum antenna diameter (m)

G is absolute gain in dB

Goa is on-axis gain

Equation	Limits	
$G = G_{0A} + C_2 \left(\frac{\theta}{\theta_0}\right)^2 + C_3$	$0 \leq \frac{\theta}{\theta_0} \leq C_1$	
$G = C_5 + C_6 \log \theta$	$C_1 < \frac{\theta}{\theta_0} \leq C_4 V$	
$G = \begin{cases} C_8 + C_9 \log (V\theta_0) + \frac{C_{10}}{V^2} \left(\frac{\theta}{\theta_0}\right)^2 \\ C_{11} + C_{12} \log \theta \end{cases}$ maximum	$C_4 V < \frac{\theta}{\theta_0} \leq \frac{C_7}{\theta_0}$	Note: If ($C_8 = -999.$) then 2nd equation is used
$G = C_{13}$	$\frac{C_7}{\theta_0} < \frac{\theta}{\theta_0}$	

The following values of the parameter for gain type 4 will produce the 1982 CPM recommended feederlink transmit antenna pattern.

PARAMETER	CO-POLARIZED GAIN PATTERN	CROSS-POLARIZED GAIN PATTERN
C_1	.5	.493
C_2	-12.	0.
C_3	0.	-30.
C_4	.635	0.
C_5	36.	0.
C_6	-20.	0.
C_7	36.3	8.91
C_8	45	-999.
C_9	-20.	0.
C_{10}	-12.6	0.
C_{11}	29.	9.0
C_{12}	-25.0	-20.
C_{13}	-10.	-10.

Arbitrary-gain-function table for Fast Roll-Off (Pattern Type 5)

Let $G(\phi) = GOA - f$

f = fall-off in dB from on-axis gain;

GOA = on-axis gain (dB)

$$x = \sqrt{\frac{\Delta G_3}{12}}\left(1 - \frac{c_2}{\phi_0}\right)$$

ΔG_3 = maximum of $(3, \Delta G)$ where ΔG is the gain fall-off at ellipse edge (dB)

Equation	Limits	Description Comment
$f = 12\left(\frac{\phi}{\phi_0}\right)^2$	$0 \leq \frac{\phi}{\phi_0} \leq \sqrt{\frac{\Delta G_3}{12}}$	Gaussian
$f = 12\left(\frac{\phi_0}{c_2}\right)^2\left(\frac{\phi}{\phi_0} - x\right)^2$	$\sqrt{\frac{\Delta G_3}{12}} < \frac{\phi}{\phi_0} \leq \frac{c_2}{\phi_0}\sqrt{\frac{c_3}{12}} + x$	Fast roll-off
$f = c_3$	$\frac{c_2}{\phi_0}\sqrt{\frac{c_3}{12}} + x < \frac{\phi}{\phi_0} \leq \sqrt{\frac{c_3}{12}}$	Upper Limit
$f = c_4 + c_5 \log_{10}\left(\frac{\phi}{\phi_0}\right)$	$\sqrt{\frac{c_3}{12}} < \frac{\phi}{\phi_0}$	Beamlet roll-off -22 + WS
$f = c_6 + GOA$	upper limit value of f	Plateau c_6 = -Final Gain

The following values of the C_i parameters in Type 5 gives the 83-WARC Fast Roll-off Satellite Antenna Pattern.

PARAMETER		CO-POLARIZED GAIN PATTERN
C_1	=	0.
C_2	=	.8
C_3	=	25.23
C_4	=	22.
C_5	=	20.
C_6	=	0.

3.3.3 INTERFERENCE MATRIX ON UNIT IMATRX

Data Base Area: Interference-Matrix

File Name - Interference Matrix

Program P3 uses an n x n interference matrix, called IGROUP, where n is the number of service areas. Each IGROUP element (I, J) has a value of 0 or 1. If it has a value of 0, no interference from the Jth service area into the Ith is calculated. The index represents the sequence number of the service area in the scenario. All elements of the matrix have a default value of 1 (i.e., calculate interference). If this file is empty (the usual case), the default values will be used which means all interference will be calculated unless inhibited for other reasons (e.g., over-the-horizon).

The default interference matrix can be changed using the data in this file. Either the whole matrix (produced by the user or the Synthesis program) or portions of it can be read from the file.

The format is shown below.

COLS.				
	01	Square-diagonal-partition (repeating group-repeats as many times as user desires)		
	05	Header Record		
1-5		10 Starting-diagonal-point (Upper left of square partition starts on diagonal at this point)	PIC 9(5)	
6-10		10 Length-of-square partition	PIC 9(5)	
	05	Matrix Row (Repeats Length-of-square times)		
1,2,3, ...,50		10 Matrix elements (Repeats Length-of-square times)	PIC 9	(0,1)

As an example, if a scenario has 10 service areas, the following entries in this file

```
    2     4
0101
1010
1100
0011
    2     3
101
010
000
(EOF)
```

WILL CREATE A 10 X 10 MATRIX AS FOLLOWS:

```
1111111111
1010111111
1101011111
1110011111
1001111111
1111111111
1111111011
1111110101
1111110001
1111111111
```

3.3.4 ELLIPSE - UP AND DOWN - UNITS IUELL1 AND IUELL2

DATA BASE AREA: ELLIPSE-IFRB
FILE NAME: ELLIPSE
RECORD TYPE: ELLIPSE

Each record on this file contains the parameters describing the geometry of an ellipse covering a service area from a possible satellite location with specified antenna pointing and rotational errors. The service area is defined by the polygon points on the Requirements File. The Ellipse File is in sort by IFRB service area number and within that by decreasing satellite longitude. Separate files are maintained by the IFRB for different combinations of errors and for up and down service areas. The records on this file are generated by the Ellipse Fit Program which generates ellipses for each service area - error combination across the available orbital arc at regular intervals.

The following parameters are contained in each record of the Ellipse file:

- Service area designation
- Satellite Longitude
- Boresight latitude and longitude (Center of Ellipse)
- Ellipse orientation angle
- Major and minor axes of ellipse
- Pointing error
- Rotational error

For each service area, the Program P1 selects the ellipse whose satellite longitude is closest to that specified in the Scenario being processed as long as it is within the specified tolerance. This means that if ellipses have been generated at two degree intervals of longitude (e.g. -50, -52, -54) and a satellite location of -51.5 is specified, the ellipse at -52 is used from this file.

Ellipse data may also be obtained from the ellipse section of DATA.PARAMS documented above.

3.3.5 REQUIREMENTS UNIT IUREQ

This file contains the data keyed from the Requirements Form submitted to the IFRB by the administrations. There is one form (record) for each service area which is to be part of the plan to be developed. The forms, which are described in detail in Appendix 2 of IFRB Circular-letter No. 522, contain information about polygon points, test points, eclipse protection time, desired orbital arc, etc. The file is maintained by the IFRB. SOUP5 uses this file, at the user's request, to obtain point-set data and the IFRB number of ellipses used from the IFRB ellipse files. The point set data may also be read from the technical parameters file documented above.

IV. REPORT OUTPUTS

4.1 PROGRAM P1 OUTPUTS

There are two types of outputs from P1:

- Formatted reports echoing the card image inputs and the binary outputs
- Binary outputs to P2

Specifically, the outputs are:

- OUT.RPT - Formatted report echoing the selected card image inputs, with error messages to assist in debugging the data; including:

  - Control Data
  - Scenario Level Data
  - RARC Parameter Data
  - Scenario Service Area & Point Override Data
  - Channelization Data
  - Protection Ratio Data
  - Point Set and Point Data
  - Beam Data
  - Antenna Characteristics Data
  - Gain Table Data

- OUT.B.CTL & OUT.W.CTL - Binary output for P2 and the corresponding formatted report for non-up/down-dependent data, including:

  - Control Data
  - Scenario Level Data
  - Scenario Description
  - RARC Parameters
  - Protection Ratio Template Table
  - Protection Ratio Entry Table
  - Beam Table
  - Antenna Characteristics Table
  - Gain Table
  - Gain Entry Table
  - Up/Down Table Sizes

- OUT.B.UP & OUT.W.UP
- OUT.B.DOWN & OUT.W.DOWN

  Binary outputs for P2 and their corresponding formatted reports for up/down dependent data, including:

  - Feederlink/Downpath Table
  - Channelization Table
  - Channel Family Table
  - Channel Table
  - Point Set Table
  - Points Table

Each of the report outputs is discussed in detailed in the following pages.

4.1.1 OUT.RPT - UNIT IURPT

OUT.RPT echos the selected input data as it is processed. The following pages provide a sample of each page of the output. The output in each page is marked to correspond to the card and field in Chapter 3 above.

DATA/FILE TYPE	IN FILE	FROM DATA BASE AREA
• Control Data	DATA.CONTROL	N/A
• Scenario-plan Data	DATA.SCENARIO	Scenario-plans
• RARC Parameter Data	DATA.PARAMS	Parameters
• Scenario Service Area & Point Override Data	DATA.SCENARIO	Scenario-plans
• Channelization Data	DATA.PARAMS	Parameters
• Protection Ratio Data	DATA.PARAMS	Parameters
• Point Set and Point Data	DATA.PARAMS	Requirements
• Beam Data	DATA.PARAMS	Results
• Antenna Characteristics Data	DATA.PARAMS	Parameters
• Gain Table Data	DATA.PARAMS	Parameters

CONTROL INPUT DATA

P1 CONTROL DATA

SCENARIO KEY	DO UP	DO DOWN	STOP CODE
LS-87110	Y	Y	99
1-8	9	10	11-12

1111111111 1111111111 1111111111 1111111111

13-40

P2 TO P5 CONTROL DATA

PROG NO.	STOP CODE	DEBUG OPTIONS	
	1-2	3-80	
2	99	00000000000000100000000000000000000000000000000000000000000000000000000000000000	Record 2
3	50	00000000000000000000000000000000000000000000000000000000000000000000000000000000	Record 3
4	50	10101010101010101010100101010101010101010101001010101010101010100000000000000000	Record 4
5	50	10101010101010101010100101010101010101010101001010101010101010100000000000000000	Record 5

SCENARIO/PLAN INPUT OVERRIDES FROM CONTROL

			********** RARC PARAMETER OVERRIDES **********													
			POINTING TOL		ROTATNL TOL		DELTA	RAIN ATTENUA	*** PROTECTION RATIO DATA ***							
SCENARIO KEY	CARD TYPE	RARC KEY	E-ANT	S-ANT (DEG)	E-ANT (DEG)	S-ANT (DB)	G	PCT WST MONTH	**TEMPLATE*** KEYS DOWN	FLT	TOTL	**CO-CHANNEL*** (DB) DOWN	FLT	TOTL		
1-8	9	10-13	14-17	18-21	22-25	26-29	30-33	34-41	42-45	46-49	50-53	54-57	58-61	62-65		

Will only appear if [illegible] Control Record 6 Exists

CHNLZTION SCHEME DEFAULT		**POINT DATA*** RQMT FILE	SELECTION OPTIONS		BEAM DATA		********** ANTENNA DATA ********** ***** DOWNPATH *****				****FEEDERLINK****				RAIN ATTENU	
DOWN	UP	OPTN	ESR	FLT	LONG. TOLER	FILE OPTN	ANT SAT	KEYS ESR	POLAR TYPE	ASMPT/ SUBSAT	FLT	ANT SAT	KEYS FLAG	POLAR AIMPT/ FLAG	CALC FLAG	MAX MRGN DB
10-13	14-17	18	19-23	24-26	27-31	32	33-36	37-40	41	42	43-46	47-50	51	52	53	54-57

Will only appear if [illegible] Control Record 7 Exists

(CARD 2 CONTINUED)

****TRANSMITTER POWER DEFAULTS****					
****DOWNPATH****			***FEEDERLINK***		
EIRP/POWER FLAG	VALUE	MAX ADJ	EIRP/POWER FLAG	VALUE	MAX ADJ
58	59-64	64-68	69	70-75	76-79

**********OUTPUT DATA OPTIONS**********

	DET	DET	P3	P2	INFR	MARGIN THRESHOLDS (DB)				PHI
						AGGREGATE		DETAIL		ZERO
AGG	1	2	BIN	GAIN	MTRX	DOWN	UP	DOWN	UP	DEG

Will only appear if optional Control Record 8 exists

(CARD 3 CONTINUED)

MAX	SINGLE	INHIBIT		NOM		NO. OF	NO. OF	CARDS	
PHI/	VICTIM	SAME-SERV	HORIZON	FRQ	GROUP	DESCR	SERV.	PRESENT	
PHI0	CHANNEL	INTERFER	KM	OPT	FLAG	CARDS	AREAS	DOWN	UP

INTERFERENCE WILL ONLY BE CALCULATED INTO THE FOLLOWING SERVICE AREAS

1-8, 11-18, 21, 28, ...

Will only appear if Control Records 9, 10, or 11 exist

43-87110

SCENARIO/PLAN INPUT DATA

********** RARC PARAMETER OVERRIDES **********

SCENARIO KEY	CARD TYPE	RARC KEY	POINTING TOL E-ANT (DEG)	POINTING TOL S-ANT (DEG)	ROTATNL TOL E-ANT (DEG)	ROTATNL TOL S-ANT (DB)	DELTA G	RAIN ATTENUA PCT WST MONTH	*** PROTECTION RATIO DATA *** **TEMPLATE*** KEYS DOWN	FLT TOTL	**CO-CHANNEL*** (DB) DOWN	FLT	TOTL
LS-87110	1	10-13	.000	0.00	0.00	0.00	3.00		42-45	50-53	0.0	0.0	0.0
1-8	9		14-17	18-21	22-25	26-29	30-33	34-41	46-49	54-57		58-61	62-65

SCENARIO KEY	CARD TYPE	CHNLZTION SCHEME DEFAULT DOWN	UP	**POINT DATA*** RQMT FILE OPTN	SELECTION OPTIONS ESR	FLT	BEAM DATA LONG. TOLER	FILE OPTN	********** ANTENNA DATA ********** ***** DOWNPATH ***** ANT SAT	KEYS ESR	POLAR TYPE	ASMPT/ SUBSAT	*****FEEDERLINK**** ANT FLT	KEYS SAT	POLAR FLAG	AIMPT/ FLAG	CALC FLAG	MAX MRGN DB
LS-87110	2	LSD1	LSU1	P	P	TI	2.00	P	ST55	MRDA	L	S	MTDA	SR55	C	A	R	1.0
1-8	9	10-13	14-17	18	19-23	27-31	27-31	32	33-36	37-40	41	42	43-46	47-50	51	52	53	54-57

(CARD 2 CONTINUED)

****TRANSMITTER POWER DEFAULTS**** ****DOWNPATH**** EIRP/POWER FLAG	VALUE	MAX ADJ	***FEEDERLINK*** EIRP/POWER FLAG	VALUE	MAX ADJ
P	10.00	0.0	P	10.00	0.0
58	59-64	65-68	69	70-75	76-79

4-7

**********OUTPUT DATA OPTIONS**********

SCENARIO KEY	CARD TYPE	AGG	DET 1	DET 2	P3 BIN	P2 GAIN	INFR MTRX	MARGIN THRESHOLDS (DB) AGGREGATE DOWN	UP	DETAIL DOWN	UP	PHI ZERO DEG
LS-87110	3	Y	Y	Y	N	N		60.0	60.0	60.0	60.0	0.4
1-8	9	10	11	12	13	14		20-24	25-29	30-34	35-39	40-43

(CARD 3 CONTINUED)

MAX PHI/ PHIO	SINGLE VICTIM CHANNEL	INHIBIT SAME-SERV INTERFER	HORIZON KM	NOM FRQ OPT	GROUP FLAG	NO. OF DESCR CARDS	NO. OF SERV. AREAS	CARDS PRESENT DOWN	UP
0.0	0	N	200.000	M	N	8	7	Y	Y
59-61	62-63	64	68-73	74	75	76	65-67	79	80

***** ABOVE VALUES REFECT SCENARIO VALUES AFTER BEING OVERRIDDEN BY VALUES FROM CONTROL FILE

SCENARIO DESCRIPTION CARDS

10

SCENARIO KEY	CARD TYPE	CARD NUM	11-80 DESCRIPTION
1-8	9		
LS-87110	4	1	*THIS SET IS A TEST OF THE LMSS SYSTEM. IT USES BOTH A AND *
LS-87110	4	2	* 8 MOBILE ANTENNAS ALONG WITH THE 55 METER SATELLITE OFFSET *
LS-87110	4	3	* PARABOLA. ONLY AREAS CO-CHANNEL WITH THE CENTER ARE BEING TESTED. *
LS-87110	4	4	*

RARC PARAMETER INPUT DATA

40-80

TEST3 PARAMETERS

RARC KEY	CARD TYPE	CRNT OFCL FLAG	MIN S-ANT BMWDTH	MAX S-ANT AXRATIO	MIN FL ANT	*******TOLERANCES******* POINTING E-ANT	POINTING S-ANT	ROTATIONAL E-ANT	ROTATIONAL S-ANT	DELTA-G TO COEF
TES4	1	Y	0.0	9.99	2.00	0.0	0.0	0.0	0.0	3.78
1-4	5	6	7-11	12-15	16-19	20-23	24-27	28-31	32-35	36-39

CHANNELIZATION PARAMETERS

		******* UPPATH ******* FREQUENCY LOWER (GHZ)	FREQUENCY UPPER (GHZ)	GUARDBAND LOWER (MHZ)	GUARDBAND UPPER (MHZ)	********DOWNPATH******** FREQUENCY LOWER (GHZ)	FREQUENCY UPPER (GHZ)	GUARDBAND LOWER (MHZ)	GUARDBAND UPPER (MHZ)	BAND WIDTH COEF
TES4	2	17.300	17.800	10.00	10.00	12.200	12.700	10.00	10.00	1.80
1-4	5	6-11	12-17	18-22	23-27	28-33	34-39	40-44	45-49	40-53

		RAIN ATTENUATION MAX RAIN MRGN	PERCENT WORST MONTH	**PROTECTION DATA** DOWN RATIO KEY	FLT RATIO KEY	TOTAL RATIO KEY	****CO-CHANNEL***** DOWN PR ZERO	FLT PR ZERO	TOTAL PR ZERO	FLT NOISE CONTRIB	OVER ALL CN	OFFICIAL PARAMETERS
TES4	3	4.0	0.1000	T4DW	T4DW	T4DW	28.0	28.0	28.0	0.0	0.0	NNNNNNNNNNNNNNNNN
1-4	5	6-9	10-17	18-21	22-25	26-29	30-33	34-37	38-41	42-45	46-51	52-78

```
SCENARIO SERVICE AREA NO.  3

SCENARIO CD  SERVICE    SB   BLOCK
     KEY TP  AREA KEY   CD   CODE

TESTOOO8  5 CAN-PE-STD  1    CANC
  1-8     9 10-12 15-17 18   19
              13-14
                              ******************  DOWNPATH   DATA  ******************

                              *BEAM-PTSET KEY*  ******* BEAM DATA *******
                                 OVERRIDE            SAT    PTNG   ROT   SAT  CHN     POLAR
                              U/D SERVICE AREA      LONG    ERR    ERR   LAT   FM     ANGLE
TESTOOO8  5 CAN-PE-STD  2                         -125.00   0.10  1.00  0.0   02       0.0
                              19  20-27             28-34  35-38  39-42 43-47 48-49  50-54
                              ************************SCENARIO  DOWNPATH  OVERRIDES ************************************
                                          DELTA                                          SAT   ESR          **TRANSMITTER**   NO.
                               E-ANT  S-ANT   G    CHNL  RQMTS  PTSEL  BMLNG  BFSEL  ANT   ANT   POL   EIRP/POWER  MAX   PNT
                               PTTOL  PTTOL   DB    KEY OPTION OPTION OPTION OPTION  KEY   KEY   FLAG  FLAG VALUE  ADJ   OVER
TESTOOO8  5 CAN-PE-STD  3       .100  0.20   0.0                        0.0                              C   14.00  0.0    0
                              19-22  23-26  27-30  31-34  35  36-40  41-45   46    47-50 51-54  55    56  57-62  63-66 67-68
                              ******************  FEEDERLINK DATA  ******************

                              *BEAM-PTSET KEY*  ******* BEAM DATA *******
                                 OVERRIDE            SAT    PTNG   ROT   SAT  CHN     POLAR
                              U/D SERVICE AREA      LONG    ERR    ERR   LAT   FM     ANGLE
TESTOOO8  5 CAN-PE-STD  4                         -125.00   0.10  1.00  0.0   01       0.0
                              19  20-27             28-34  35-38  39-42 43-47 48-49  50-54
                              ****************************** SCENARIO FEEDERLINK OVERRIDES ******************************

                                          DELTA                                          FLT   SAT          **TRANSMITTER**   NO.
                               E-ANT  S-ANT   G    CHNL  RQMTS  PTSEL  BMLNG  BFSEL  ANT   ANT   POL   EIRP/POWER  MAX   PNT
                               PTTOL  PTTOL   DB    KEY OPTION OPTION OPTION OPTION  KEY   KEY   FLAG  FLAG VALUE  ADJ   OVER
TESTOOO8  5 CAN-PE-STD  5       .100  0.20   0.0                        0.0          CPM8  77UC          C   14.00  0.0    0
                              19-22  23-26  27-30  31-34  35  36-38  41-45   46    47-50 51-54  55    56  57-62  63-66 67-68
```

CHANNELIZATION INPUT DATA

CHZ KEY	CARD TYPE	UP/ DOWN	LOWEST FREQ (GHZ)	NO.OF CHNLS	CHNL BNDWTH (MHZ)	CHNL SEP. (MHZ)	CH.NOISE BNDW (MHZ)	TOP B-B FRQ (MHZ)	P-P DEV (MHZ)	OFFL FLAG	NO.OF CHML FAMS
CTS1	1	U	17.400	40	10.00	10.00	22.00	2.00	8.00	N	1
1-4	5	6	7-13	14-15	16-20	21-25	26-30	31-35	36-40	41	42-43

	CHNL FAM NUM	CARD NUM	NO.OF CHNLS IN FAM	CHANNELS
CTS1	2	1	8	4 8 12 16 24 28 32 36
1-4	5	6-6	8	9-10 11-12 13-14 ... etc.

CHZ KEY	CARD TYPE	UP/ DOWN	LOWEST FREQ (GHZ)	NO.OF CHNLS	CHNL BNDWTH (MHZ)	CHNL SEP. (MHZ)	CH.NOISE BNDW (MHZ)	TOP B-B FRQ (MHZ)	P-P DEV (MHZ)	OFFL FLAG	NO.OF CHML FAMS
CTS4	1	D	12.400	36	10.00	14.70	22.00	5.00	12.00	N	4

	CHNL FAM NUM	CARD NUM	NO.OF CHNLS IN FAM	CHANNELS
CTS4	2	1	5	1 3 5 7 9
CTS4	2	2	5	2 4 6 8 10
CTS4	2	3	1	2
CTS4	2	4	1	15

PROTECTION RATIO TEMPLATE TABLE INPUT DATA

			********** SEGMENT PARAMETERS **********							
KEY	CRD NUM	NO.OF SEG	UPPER LIMIT	END VALUE (DB)	SLOPE (DB)	OFFSET	UPPER LIMIT	END VALUE (DB)	SLOPE (DB)	OFFSET
1-4	5	6-7	9-16	17-24	25-32	33-48	41-48	49-56	57-64	65-72
T4DW	1	5	-0.920	-23.000	71.000	-0.920	-0.274	0.0	35.600	-0.274
T4DW	2		0.274	0.0	0.0	0.0	0.920	0.0	-35.600	0.274
T4DW	3		0.0	-23.000	-71.000	0.920				

POINT SET AND POINT INPUT DATA

PNT KEY	CRD TYP	SERVICE AREA	UP/ DN	OFFL SET	RN ZN	NO.OF PNTS	COMMENT
AHRZ	1	AHO-RZ-TST	D	N	B	2	TEST FOR OVER HORIZON CARRIER
1-4	5	6-13	14	15	16	17-18	

PNT KEY	CRD TYP	SERVICE AREA	UP/ DN	OFFL SET	RN ZN	NO.OF PNTS	COMMENT
AHRZ	1	AHO-RZ-TST	D	N		2	TEST FOR OVER HORIZON CARRIER

	PNT NUM	PNT TYP	LOCATION LAT.	LOCATION LONG.	ELEV. METERS	RN ZN	PNT NUM	PNT TYP	LOCATION LAT.	LOCATION LONG.	ELEV. METERS	RN ZN	PNT NUM	PNT TYP	LOCATION LAT.	LOCATION LONG.	ELEV. METERS	RN ZN
AHRZ	2	1	P	40.00	60.00	0. B	2	P	40.00	70.00	0. B							
1-4	5	6-9	10	11-16	17-23	24-28	29	31-34	35	36-41	42-48	49-53	54	55-59	60	61-66	67-73	74-78

PNT KEY	CRD TYP	SERVICE AREA	UP/ DN	OFFL SET	RN ZN	NO.OF PNTS	COMMENT
CA4D	1	CAN-ON-STD	D	N	B	3	CANADA ONTARIO AREA. CANADIAN TEST DATA

4-12

PNT KEY	CRD TYP	SERVICE AREA	UP/ DN	OFFL SET	RN ZN	NO.OF PNTS	COMMENT
CA4D	1	CAN-ON-STD	D	N		3	CANADA ONTARIO AREA. CANADIAN TEST DATA

	PNT NUM	PNT TYP	LOCATION LAT.	LOCATION LONG.	ELEV. METERS	RN ZN	PNT NUM	PNT TYP	LOCATION LAT.	LOCATION LONG.	ELEV. METERS	RN ZN	PNT NUM	PNT TYP	LOCATION LAT.	LOCATION LONG.	ELEV. METERS	RN ZN
CA4D	2	1	P	70.00	-95.00	0. B	2	P	70.00	-80.00	0. B		3	P	60.00	80.00	0. B	

PNT KEY	CRD TYP	SERVICE AREA	UP/ DN	OFFL SET	RN ZN	NO.OF PNTS	COMMENT
CA1D	1	CAN-PA-STD	D	N	B	8	CANADA PACIFIC AREA. CANADIAN TEST DATA

	PNT NUM	PNT TYP	LOCATION LAT.	LOCATION LONG.	ELEV. METERS	RN ZN	PNT NUM	PNT TYP	LOCATION LAT.	LOCATION LONG.	ELEV. METERS	RN ZN	PNT NUM	PNT TYP	LOCATION LAT.	LOCATION LONG.	ELEV. METERS	RN ZN
CA1D	2	1	P	70.00	-141.00	0. B	2	P	70.00	-120.00	0. B		3	P	60.00	-120.00	0.	
CA1D	2	4	P	49.00	-114.00	0. B	5	I	70.00	-130.00	2989. C		6	B	49.00	-120.00	0.	
CA1D	2	7	E	81.00	-145.00	0. D	8	I	70.00	-130.00	0. B							

BEAM INPUT DATA

********** BEAM ID **********							ORIENT/REFERENCE ANG.					
*** BEAM KEY ***		SAT	PTNG	ROT	AIMPOINT		ORIENT/			MAJOR	MINOR	OFFL
U/D	SERVICE AREA	LONG.	ERR	ERR	LAT.	LONG.	FLAG	REF.LAT	REF.LNG	AXIS	AXIS	FLAG
		10-15	16-19	20-23	24-29	30-36	37	38-44	45-51	52-56	57-61	62
D	AHO-RZ -TST	-100.00	0.10	1.00	40.00	-70.00	C	0.0	0.0	0.60	0.60	N
D	CAN-ON -STD	-125.00	0.10	1.00	52.06	-88.60	O	147.98	0.0	3.88	0.77	N
D	CAN-PA -STD	-145.00	0.10	1.00	57.13	-126.32	O	155.81	0.0	3.04	0.95	N
D	CAN-PE -STD	-125.00	0.10	1.00	56.79	-101.61	O	149.71	0.0	2.26	1.08	N
D	USA-CT -STC	-135.00	0.10	1.00	36.40	-98.10	R	26.70	-89.00	4.08	1.74	N
U	ATN-TS -PNT	-70.00	0.10	1.00	0.0	0.0	C	0.0	0.0	0.60	0.60	N
U	CAN-PA -STD	-145.00	0.10	1.00	51.00	-126.00	C	0.0	0.0	0.60	0.60	
U	CAN-PE -STD	-125.00	0.10	1.00	54.00	-92.00	C	0.0	0.0	0.60	0.60	
U	USA-CT -STC	-135.00	0.10	1.00	36.40	-98.10	R	26.70	-89.00	2.91	1.24	N

ANTENNA INPUT DATA

ANT KEY	EARTH/ SPACE	XMIT/ RCV	E-ANT DIAM/ CVRAGE ANG FLAG	VALUE	EAP	FIG OF MERIT/ RCVR NOISE T FLAG	VALUE	GAIN TABLKEY CO	X	OFFL FLAG	
1-4	5	6	7	8-12	13-16	17	18-23	24-27	28-31	32	33-80
CPM8	E	T	D	4.00	0.55		0.0	41AA	42AA	N	CPM 42 FEEDERLINK
FSS1	E	T	D	4.50	0.55		0.0	31	23	N	
TSUT	E	T	D	7.00	0.55		0.0	31	23	N	
77DR	E	R	D	0.75	0.55	N	1200.00	13	24	N	
77DT	S	T		0.0	0.55		0.0	12	22	N	
77UC	S	R		0.0	0.55	M	15.74	12	22	N	
77UR	S	R		0.0	0.55	N	1500.00	12	22	N	

4.1.2 P1 BINARY OUTPUT ECHOS

The following three reports echo the data in the binary file interface between P1 and P2.

REPORT FILE	CONTENTS
1. Control & non-up/down-dependent data output echos Write unit = IUWCTL	- Control data - Program 1 Internal Data - Scenario level data - RARC parameter data - Service area data - Protection ratio data - Beam data - Antenna Characteristics data - Gain Table & Gain Entry data - Up and Down Table sizes
2.&3. Up & down data table echos Write unit up = IUW(1) down = IUW(2)	- Up & Down Path data - Channelization/Channel Family/ Channel Data - Point set and point data

These files are shown exactly what the output of program 1 is. They are meant more for programmers then for the user. However, they still can be useful to the user who wants to confirm that program 1 is producing the expected output.

The following pages present a sample page of each of output with an accompanying explanation.

4.1.2.1 CONTROL & NON-UP/DOWN DEPENDENT DATA ECHO IN OUT.CTL

DATA.P1 ECHO

The report on the following pages is an echo of Data.P1, and is of interest to programmers only. For further information see the SOUP5V3.8 Programmers Manual.

CONTROL DATA ECHO

LABELED IN SAMPLE AS				
A	Scenario key	SCENAR	A8	D
B	P2 stop code	ISTOP		I
C	P2 debug option occurs 78	IDEBUG(78)		I
D	P3 stop code	ISTOP		I
E	P3 debug option occurs 78	IDEBUG(78)		I
F	P4 stop code	ISTOP		I
G	P4 debug option occurs 78	IDEBUG(78)		I
H	P5 stop code	ISTOP		I
I	P5 debug option occurs 78	IDEBUG(78)		I

```
CONTROL DATA

 SCENARIO=TESTOOO8  A


P2 CONTROL DATA
   STOP CODE=50 B            C
   DEBUG=00000000000000000000000000000000000000000000000000000000000000000000000000000000000000

P3 CONTROL DATA
   STOP CODE=50 D            E
   DEBUG=00000000010000000000000000000000000000000000000000000000000000000000000000000000000000

P4 CONTROL DATA
   STOP CODE=50 F            G
   DEBUG=10101010101010101010101001010101010101010101010101001010101010101010101000000000000000

P5 CONTROL DATA
   STOP CODE=50 H              I
   DEBUG=10101010101010101010101001010101010101010101010101001010101010101010101000000000000000
```

SCENARIO LEVEL DATA ECHO

LABELED ON SAMPLE AS	
A	Polarization Reference point flag-up 1 = aimpoint, 2 = subsatellite point up
B	Polarization Reference point flag-down 1 = aimpoint, 2 = subsatellite point down
C	Rain-attenuation calculation flag 1 = clear, 2 = rain, 3 = both
D	P3 Aggregate Report Flag P3 Detail Report #1 P3 Detail Report #2 P3 Binary Output P2 Gain Table Graphs 1 = yes, 0 = no
E	Aggregate-Report-Margin Threshold UP
F	Aggregate-Report-Margin Threshold DOWN
G	Detail-Report-C/I Threshold UP
H	Detail-Report-C/I Threshold DOWN
I	P2 Gain Table Graph PHI-ZERO
J	Nominal Frequency Option 1 = Low, 2 = Middle, 3 = High

SCENARIO LEVEL DATA ECHO

LABELED ON SAMPLE AS	
K	Blocking-in-effect-flag 1 = yes, 0 = no
L	Number of scenario description lines
M	Number of Service Areas
N	Distance for Horizon effect
O	Maximum allowed rain margin uppath
P	Inhibit Same-serv-area-same-channel-family flag 1=yes, 0=no
Q	Single victim channel 0 = calculate all channels, else calculate interference into this channel only
R	Maximum Phi/PhiØ. If not equal to zero, inhibit interference calculations when either antenna has a Phi/PhiØ greater than this value.
S	I=1,..., number of description records Scenario description record

SCENARIO LEVEL DATA

ATMOSPHERIC SUBSAT UP	ATMOSPHERIC SUBSAT DOWN	RAIN ATTEN CALC	OUTPUT OPTIONS	MARGIN THRESHOLDS (DB) AGGREGATE DOWN	AGGREGATE UP	DETAIL DOWN	DETAIL UP	PHI ZERO DEG	NOM FRQ OPT	BLOCK FLAG	NO. OF DESCR LINES	NO OF SERV. AREAS	HORIZON	MAX RAIN MARGIN UP
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	..	2	111100	100.0	100.0	100.0	100.0	2.0	2	0	8	6	200.00	4.00

INHIBIT SAME-SERV INTERFER	SINGLE VICTIM CHANNEL	MAXIMUM PHI/PHIO
1	0	0.00
P	Q	R

SCENARIO DESCRIPTION CARDS S

```
*THIS SET HAS FOLLOWING CHARACTERISTICS.  NO BLOCKING, RAIN ATTN,      *
*   ALL POINTS SELECTED, 1 CHANNELIZATION, PROT RATIO                  *
*CALCULATED,  POINTING ERRORS, C/N WITH G/T AND TEMP, BEAM CALL        *
*BY ID , NOM FREQ=1,  SOME CARRIERS OVER HORIZON                       *
*DB.  RAIN MARGIN, CANONSTD HAS C/N WITH MANY FEEDERLINKS.             *
*USES FAST ROLL-OFF SATELLITE ANTENNA AND CPM FEEDERLINK ANTENNA.      *
*     -- SAME AS TEST0005 EXCEPT NO BLOCKING --                        *
*     ---- TEST FOR OVER THE HORIZON CARRIER ----                      *
```

RARC PARAMETERS ECHO

LABELED ON SAMPLE AS	
A	RARC Parameter Key*
B	Percent of worst month
C	Max allowed rain margin downpath
	Channelization Parameters
D	Uppath lowest frequency (ghz)
E	Uppath highest frequency (ghz)
F	Uppath lower guard bandwidth (mhz)
G	Uppath upper guard bandwidth (mhz)
H	Downpath lowest frequency (ghz)
I	Downpath highest frequency (ghz)
J	Downpath lower guard bandwidth (mhz)
K	Downpath upper guard bandwidth (mhz)
L,M	Co-channel protection ratio (dB) 1 = up, 2 = down
N	Co-channel total protection ratio (dB)

RARC PARAMETERS ECHO

LABELED ON SAMPLE AS	
O,P	Index to protection ratio table O = up, P = down
Q	Index to total protection ratio
R	Bandwidth coefficient
S	FLT-noise-contribution (dB)
T	Overall C/N (dB)
U	Min FLT ant diameter
V	Protection ratio key - up*
W	Protection ratio key - down*
X	Protection ratio key - total*

*Not in binary output

RARC PARAMETERS

			FEEDERLINK				DOWNPATH			
	PCT-WST	MAX RAIN	FREQUENCY(GHZ)		GUARDBAND(MHZ)		FREQUENCY(GHZ)		GUARDBAND(MHZ)	
KEY	MONTH	MARGIN	LOWER	UPPER	LOWER	UPPER	LOWER	UPPER	LOWER	UPPER
A	B	C	D	E	F	G	H	I	J	K
TES4	0.1	4.0	17.300	17.800	10.00	10.00	12.200	12.700	10.00	10.00

	PROTECTION RATIO											
	CO-CHANNEL			INDICES				FLT	OVER	FLT		
	UP	DOWN	TOTAL	UP	DOWN	TOTAL	BNDWDTH COEF	NOISE CONTRIB	ALL CN	MIN ANT	PROT.RATIO UP	PROT.RATIO DOWN	KEYS TOTL
	L	M	N	O	P	Q	R	S	T	U	V	W	X
	28.00	28.00	29.90	1	1	1	1.800	0.0	0.0	2.00	T4DW	T4DW	T4DW

SERVICE AREA TABLE DATA ECHO

LABELED IN
SAMPLE AS

Passed to P2:
For I=1, to number of service areas

A	Index of service area
B	ITU admin abbrev
C	Area-designator
D	Area type
E	Block-code
F	Number of service areas

SERVICE AREA TABLE

NSERVA= 6 F

INDEX	ADMIN	AREA	ARTYPE	IBLKCD
G	A	B	C	
1	AHO	RZ	TST	CANW
2	CAN	PA	STD	CANW
3	CAN	PE	STD	CANC
4	CAN	ON	STD	CANC
5	USA	CT	STC	
6	ATN	TS	PNT	

PROTECTION RATIO TABLE ECHO

LABELED IN SAMPLE AS	
A	Number of protection ratio templates
B	Number of protection ratio entries in all templates
C	Protection ratio template key*
D	Index of protection ratio template*
E	Index to starting location of protection ratio template
F	Number of segments in template*
G,H,I,J	Protection ratio template entries

Additional details of Template Entries

G	Upper limit in segment (not used for last segment) in normalized frequency. Normalized frequency is frequency divided by Carson's Rule Bandwidth (Peak-to-peak modulation + 2 * Top-baseband - frequency)
H	Segment-value-at-offset. Value of protection ratio drop off from channel value at offset
I	Slope of segment in terms of dB/(normalized-frequency)
J	Offset of segment (see item H above)

Note: At a normalized frequency FD

$$\text{Protection Ratio} = PR_0 - (\text{End value} + \text{slope} * (FD - \text{Offset}))$$

PROTECTION RATIO TEMPLATE AND ENTRY TABLES

LENGTH OF TEMPLATE TABLE= A 1 LENGTH OF ENTRY TABLE= B 21

KEY	*TMPLT* *TABLE* CRD IDX (C)	POS (D)	NO.OF SEG (E)	PROTECTION RATIO ENTRY TABLE * UPPER LIMIT (F)	END VALUE (DB) (G)	SLOPE (DB) (H)	OFFSET (I)	* UPPER LIMIT (J)	END VALUE (DB) (G)	SLOPE (DB) (H)	OFFSET (I)
T4DW	1	1	5	-0.920	-23.000	71.000	-0.920	-0.274	0.0	35.600	-0.274
				0.274	0.0	0.0	0.0	0.920	0.0	-35.600	0.274
				0.0	-23.000	-71.000	0.920				

ELLIPSE TABLE DATA ECHO

LABELED IN SAMPLE AS			
	Passed to P2:		
A	Number of beams		
B	Index to beam table		
C	Beam key		
D	Major axis		degrees
E	Minor axis		degrees
F	Aimpoint latitude		degrees north
G	Aimpoint longitude		degrees east
H	Orientation ang or ref pnt flag (1=orient. ang., 2=ref pnt)		
I	Orientation angle or ref pnt latitude		degrees or degrees north
J	Ref point longitude	R	degrees east

BEAM TABLE

NUMBER OF BEAMS= 9 A

INDEX	KEY B	C	AXSMJ D	AXSMN E	AIMLT F	AIMLN G	IOARFL H	ORAN1 I	ORAN2 J
1	DAHORZTST		0.60	0.60	40.00	-70.00	0	0.0	0.0
2	DCANPASTD		3.04	0.95	57.13	-126.32	1	156.81	0.0
3	UCANPASTD		0.60	0.60	51.00	-126.00	0	0.0	0.0
4	DCANPESTD		2.26	1.08	56.79	-101.61	1	149.71	0.0
5	UCANPESTD		0.60	0.60	54.00	-92.00	0	0.0	0.0
6	DCANONSTD		3.88	0.77	52.06	-88.60	1	147.98	0.0
7	DUSACTSTC		4.08	1.74	36.40	-98.10	2	26.70	-89.00
8	UUSACTSTC		2.91	1.24	36.40	-98.10	2	26.70	-89.00
9	UATNTSPNT		0.60	0.60	0.0	0.0	0	0.0	0.0

ANTENNA CHARACTERISTICS TABLE ECHO

LABELED IN SAMPLE AS		
	Passed to P2:	
A	Number of antennas	
B	Diameter or coverage angle (1=diameter, 2=coverage angle, 0 or blank = satellite antenna (not relevant))	
C	Diameter or coverage angle	meters or degrees
D	Fig. of merit or rcvr noise temp flag (1=fig. of merit, 2=noise temp)	
E	Figure of merit or rcvr noise temp	dB/K or K
F	Antenna Aperture Efficiency	
G	Index to Copolar gain table	
H	Index to Xpolar gain table	
	Additional debug output:	
I	Index to antenna char. set	
J	Key of antenna characteristics set	

ANTENNA TABLE

NUMBER OF ANTENNAS= 7A

INDEX	KEY	IDCFL	DIACV	IFNFL	TEMGT	EAP	ICGN	IXGN
I	J	B	C	D	E	F	G	H
1	77DR	1	0.75	2	1200.00	0.55	5	6
2	77DT	0	0.0	0	0.0	0.55	7	8
3	TSUT	1	7.00	0	0.0	0.55	3	4
4	77UR	0	0.0	2	1500.00	0.55	7	8
5	CPM8	1	4.00	0	0.0	0.55	1	2
6	77UC	0	0.0	1	15.74	0.55	7	8
7	FSS1	1	4.50	0	0.0	0.55	3	4

GAIN TABLE AND GAIN ENTRY TABLE ECHO

LABELED IN
SAMPLE AS

Gain table:

A	Number of gain tables	NGT	I
B	Gain pattern number	NGPAT(I)	I
C	Index to starting location in gain-entry table	IGENT(I)	I
D	Calculation option flag	IGCAL(I)	I
M	Gain table description	IGDES	I

LABELED IN
SAMPLE AS

Gain entry table:

E	Number of gain table entries	LGET	I
F-J	Gain entry	RNTRY(I) INTRY(I)	equivalenced to I

(Written as one record)

Ordering notes for a particular table

if pattern = 01 or 02

			TYPE	
F	05	Number of segments	I	
	05	Segment * (RG)	-	
G	10	Segment equation type	I	
H	10	Upper segment limit[t]	R	units can vary
I	10	No. of coefficients	I	
	10	Coefficient * (RG)	R	units can vary

if pattern = (not yet implemented)

05	Number of parameters	I	
05	Number of coordinate sets	I	
05	Parameter * (RG)	R	units can vary
05	Coordinate set * (RG)	-	

[t] If positive limit is on â (off axis angle)
If negative limit is on $\hat{a}/\hat{a}_o$ (â divided by antenna beamwidth)

		10	Earth longitude or off-axis-angle	R degrees
		10	Earth latitude or orientation-angle	R degrees
		10	Gain	R dB

if pattern = (not yet implemented)

		05	Number of fixed parameters	I
		05	Number of repeating parameters	I
		05	Fixed parameter * (RG)	R units can vary
		05	Repeating parameter * (RG)	R units can vary

if pattern = 4 or 5

F		05	Number of parameters	I
G-J		05	Parameter * (RG)	R units can vary

Additional debug outputs:

K	Index to gain table	IGT
L	Key to gain table	KGAIN

GAIN AND GAIN ENTRY TABLES

NGT= 8 A LGET= 180 E

********GAIN TABLE*******					NPARAM/	PARAM/	PARAM/	PARAM/	PARAM/	PARAM/	PARAM/
1	KGAIN	NGPAT	IGENT	IGCAL	INOSEG	IEQTYP	LIMIT*	NCOEFF	COEFF	COEFF	COEFF
K	L	B	C	D	F	G	H	I	J	J	J
1	41	4	153	0	13	CPM-82 UPLINK TRANSIT CO-POLARIZED					
						0.500000	-12.0000	0.0	0.635000	36.0000	-20.0000
						36.3000	45.0000	-20.0000	-12.6000	29.0000	-25.0000
						-10.0000					
2	42	4	167	0	13	CPM-82 UPLINK TRANSMIT CROSS-POLARIZED (M)					
						0.493000	0.0	-30.0000	0.0	0.0	0.0
						8.91000	-999.000	0.0	0.0	9.00000	-20.0000
						-10.0000					
3	31	2	132	0	4	FSS CCIR 1978 PATTERN MAIN LOBE GAUSSIAN COPOLAR					
					1	2	0.354000	3	12.0000	0.0	2.00000
					2	1	0.711000	1	20.0000		
					3	4	47.9000	2	-32.0600	25.0000	
					4	4	999.000	2	10.0000	0.0	
4	23	1	77	0	3	UPLINKK TRANSMIT CROSSPOLAR ORI					
					1	1	-4.10000	1	25.0000		
					2	3	-174.400	4	9.70000	25.0000	1.00000
									0.0		
					3	4	-999.000	2	10.0000	0.0	
5	13	1	24	0	5	77 WARC EARTH STATION RECEIVE COPOLAR REGION 2					
					1	1	-.250000	1	0.0		
					2	2	-.707000	3	12.0000	0.0	2.00000
					3	3	-1.26000	4	9.00000	20.0000	1.00000
									0.0		
					4	3	-15.1400	4	8.50000	25.0000	1.00000
									0.0		
					5	1	-999.000	1	38.0000		
6	24	1	94	0	7	77 WARC EARTH STATION RECEIVE CROSSPOLAR REGION 2					
					1	1	-.250000	1	25.0000		
					2	3	-.440000	4	30.0000	40.0000	-1.00000
									1.00000		
					3	1	-1.40000	1	20.0000		
					4	3	-2.00000	4	30.0000	25.0000	1.00000
									1.00000		
					5	1	-7.24000	1	30.0000		

```
                                6        3       -15.1400        4       8.50000      25.0000      1.00000
                                                                                0.0
                                7        1       -999.000        1       38.0000

7 12        1       1       0   4    77WARC SATELLITE TRANSMIT COPOLAR
                                1        2       -1.58000        3       12.0000      0.0          2.00000

                                2        1       -3.16000        1       30.0000
                                3        3       -998.000        4       17.5000      25.0000      1.00000
                                                                                0.0
                                4        4       -999.000        2       0.0          0.0

8 22        1       53      0   4    77 WARC SATELLITE TRANSMIT CROSSPOLAR
                                1        3       -.330000        4       40.0000      40.0000      -1.00000
                                                                                1.00000
                                2        1       -1.67000        1       33.0000
                                3        3       -998.000        4       40.0000      40.0000      1.00000
                                                                                1.00000
                                4        4       -999.000        2       0.0          0.0
```

* SEGMENT LIMIT IS ABSOLUTE VALUE OF NUMBER,
* IF NEGATIVE THE LIMIT IS ON PHI/PHI ZERO.
* IF POSITIVE THE LIMIT IS ON PHI

UP AND DOWN TABLE SIZE ECHO

LABELED IN
SAMPLE AS

Output to P2:

A	Number of feederlink sets	NPS(1)	I
B	Number of downpath sets	NPS(2)	I
C	Length of points table up	LGP(1)	I
D	Length of points table down	LGP(2)	I
E	Length of channelization table up	LCNT(1)	I
F	Length of channelization table down	LCNT(2)	I
G	Length of Channel family table up	LCHF(1)	I
H	Length of Channel family table down	LCHF(2)	I
I	Length of Channel table up	LCTB(1)	I
J	Length of Channel table down	LCTB(2)	I

UP AND DOWN TABLE SIZE ECHO

LABELED IN
SAMPLE AS

Output to P2:

A	Number of feederlink sets	NPS(1)	I
B	Number of downpath sets	NPS(2)	I
C	Length of points table up	LGP(1)	I
D	Length of points table down	LGP(2)	I
E	Length of channelization table up	LCNT(1)	I
F	Length of channelization table down	LCNT(2)	I
G	Length of Channel family table up	LCHF(1)	I
H	Length of Channel family table down	LCHF(2)	I
I	Length of Channel table up	LCTB(1)	I
J	Length of Channel table down	LCTB(2)	I

UP AND DOWN TABLE SIZES

PT SETS		POINTS		CHZNTNS		CH FAMS		CHANNLS	
UP	DN	UP	DN	UP	DN	UP	DN	UP	DN
6	6	12	22	1	1	1	4	8	12
A	B	C	D	E	F	G	H	I	J

4.1.2.2 UP AND DOWNPATH TABLES ECHO

The data table echos listed in the following pages occur for both feederlink and downpath data.

FEEDERLINK/DOWNPATH TABLE

LABELED IN SAMPLE AS	
A	Service Area Number*
B	Index to beam table
C	Index to satellite antenna table
D	Index to channel family table
E	Satellite EIRP, C/N, or powe or PFD flag (1 = EIRP, 2 = C/N, 3 = power, 4 = PFD)
F	EIRP, C/N, power, or PFD
G	Max power adjustment
H	Satellite antenna pointing tolerance
I	Earth antenna pointing tolerance
J	Circular or Linear Polarization flag (1 = Circular, 2 = linear)
K	Polarization-angle

---

* Not in binary output

LABELED IN SAMPLE AS	
L	Delta G to edge
M	Satellite Longitude
N	Satellite Latitude
O	Beam File Key* (1 = Requirements, 2 = Parameters)
P	Beam Key or ID type* (not used) (1 = Key, 2 = ID)
Q	Beam Key*
R	Satellite Antenna Key*
S	Channelization Key*
T	Channel family Key*
U	Beam pointing error*
V	Beam Rotational error*

*Not in binary output

PATH TABLE

I	IDX BM	IDX ANT	CHP FM	P F	SAT PWR	PWR ADJ	S A PTL	E A PTL	PL FI	POLAR ANG	DELT G	SATLONG	SAT LAT	F	T	U/D	BEAM KEY SERVICE AREA	PNT ERR	ROT ERR	SANT KEY	CHZ KEY	CH FM
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P		Q	U	V	R	S	T
1	1	4	1	4	-102.6	0.0	0.0	.0	2	90.0	3.78	-100.00	0.0	2	0	D	AHO-RZ-TST	0.100	1.000	77UR	CTS1	01
2	3	4	1	4	-102.6	0.0	0.0	.0	2	90.0	3.78	-144.50	0.0	2	0	U	CAN-PA-STD	0.100	1.000	77UR	CTS1	01
3	5	6	1	2	14.0	0.0	0.20	.100	2	0.0	3.78	-125.00	0.0	2	0	U	CAN-PE-STD	0.100	1.000	77UC	CTS1	01
4	6	4	1	3	124.0	0.0	0.0	.0	2	0.0	3.78	-125.00	0.0	2	0	D	CAN-ON-STD	0.100	1.000	77UR	CTS1	01
5	8	4	1	3	251.0	0.0	0.0	.0	2	0.0	3.78	-135.00	0.0	2	0	U	USA-CT-STC	0.100	1.000	77UR	CTS1	01
6	9	4	1	3	1.0	0.0	0.0	.0	2	0.0	3.78	-70.00	0.0	2	0	U	ATN-TS-PNT	0.100	1.000	77UR	CTS1	01

CHANNELIZATION TABLE ECHO

LABELED IN SAMPLE AS	
A	Channelization Index*
B	Channelization Key*
C	Lowest frequency
D	No. of channels in scheme
E	Channel bandwidth
F	Channel separation
G	Channel noise bandwidth
H	Top baseband frequency
I	Peak-to-peak deviation
J	Index of Channel family*
K	Channelization and Family Key*
L	Index of first channel in family
M	Index of last channel in family
N	Index of channelization scheme in channelization table
O	Channel numbers

* Not written on binary file

FEEDERLINK DATA

CHANNELIZATION TABLE

INDEX	KEY	FRQL	NCHNZ	CHBW	CHSEP	CHNSBW	TBBFRQ	PPDEV
A	B	C	D	E	F	G	H	I
1	CTS1	17.400	40	10.00	10.00	22.00	2.00	8.00

CHANNEL FAMILY AND CHANNEL TABLES

INDEX	KEY	I1CHN	I9CHN	ICHNZ	CHANNELS (24 PER LINE)
J	K	L	M	N	O
1	CTS101	1	8	1	4 8 12 16 24 28 32 36

POINTS TABLE ECHO

LABELED IN SAMPLE AS	
A	Index of service area*
B	Index of last ground point in service area
C	Index of ground point
D	Point latitude (deg)
E	Point longitude (deg)
F	Point elevation (m)
G	Point rain zone Ranges from 1-14, corresponding A, B, C, D, E, F, G, H, J, K, L, M, N, P
H	Index to ground antenna parameters
I	Earth station EIRP, C/N, power or PFD flag (0 = none, 1 = EIRP, 2 = C/N, 3 = power, 4 = PFD)
J	EIRP, C/N, power, or PFD

*Not written on binary file

FEEDERLINK DATA

POINT SET AND POINT TABLE

ISERVA= 1 A IENDP= 2 B

C INDEX	D PTLAT	E PTLNG	F PTELE	G IRNZN	H IEANT	I IEPFL	J EPWR
1	40.00	60.00	0.	2	3	2	14.0
2	40.00	70.00	0.	2	3	2	14.0

ISERVA= 2 IENDP= 5

INDEX	PTLAT	PTLNG	PTELE	IRNZN	IEANT	IEPFL	EPWR
3	50.00	-130.00	0.	3	3	2	14.0
4	51.00	-126.00	0.	3	3	2	14.0
5	49.00	-120.00	0.	3	3	2	14.0

ISERVA= 3 IENDP= 7

INDEX	PTLAT	PTLNG	PTELE	IRNZN	IEANT	IEPFL	EPWR
6	56.90	-89.00	0.	3	5	2	14.0
7	52.80	-95.20	0.	3	5	2	14.0

ISERVA= 4 IENDP= 10

INDEX	PTLAT	PTLNG	PTELE	IRNZN	IEANT	IEPFL	EPWR
8	70.00	-95.00	0.	2	3	2	14.0
9	70.00	-80.00	0.	2	3	2	14.0
10	60.00	80.00	0.	2	3	2	14.0

ISERVA= 5 IENDP= 11

INDEX	PTLAT	PTLNG	PTELE	IRNZN	IEANT	IEPFL	EPWR
11	41.80	-87.70	0.	2	7	3	30.0

ISERVA= 6 IENDP= 12

INDEX	PTLAT	PTLNG	PTELE	IRNZN	IEANT	IEPFL	EPWR
12	0.0	0.0	0.	3	7	3	2.0

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4.2 PROGRAM P2 OUTPUTS

There are two report-type outputs from P2:

- Gain Table Graphs, as part of the output on unit IDIAG
- Error messages generated during calculations, on unit IERUNT

Each of these is discussed on the following pages.

4.2.1 GAIN TABLE GRAPHS

Program P2 allows the user to test all the gain tables used in the scenario. A flag of "Y" in IOUTOP (5) in Card 3 of the scenario causes graphs of gain vs. off-axis angle for all gain types to be printed on the diagnostic output unit. A marked copy of the output produced by IOUTOP(5) is shown below. The description of each marked variable follows. The antenna beamwidth to be used for the graph is an input on Card 3 of the Scenario.

Labeled on Sample	Variable	Description
A	GTBL	Gain and gain entry table number
B	NGT	Total number of gain tables in scenario
C	LGET	Total number of gain table entries
D	NGPAT	Gain pattern number
E	IGENT	Index to starting location of gain entry table
F	IGCAL	Calculation option flag
G		Number of segments
H		Description of the gain table
I		Gain table parameters
J		The off-axis angle (deg)
K		Off-axis angle divided by beamwidth (note: Beamwidth is an input parameter read from record 3 columns 40-43 of Scenario File or record 1 columns 43-47 of Data.Control file. For this test it is set to 2^{o})
L		Antenna gain
M		Numerical antenna gain
N		Gain (dB) minus on-axis gain (on-axis gain is set to 60 dB)

The off-axis angle is incremented by $.1^{o}$ from 0^{o} to 10^{o}, by $.5^{o}$ from 10.5^{o} to 20^{o}, then by 5^{o} from 25^{o} to 100^{o}.

GAIN AND GAIN ENTRY TABLE NO. 5 A

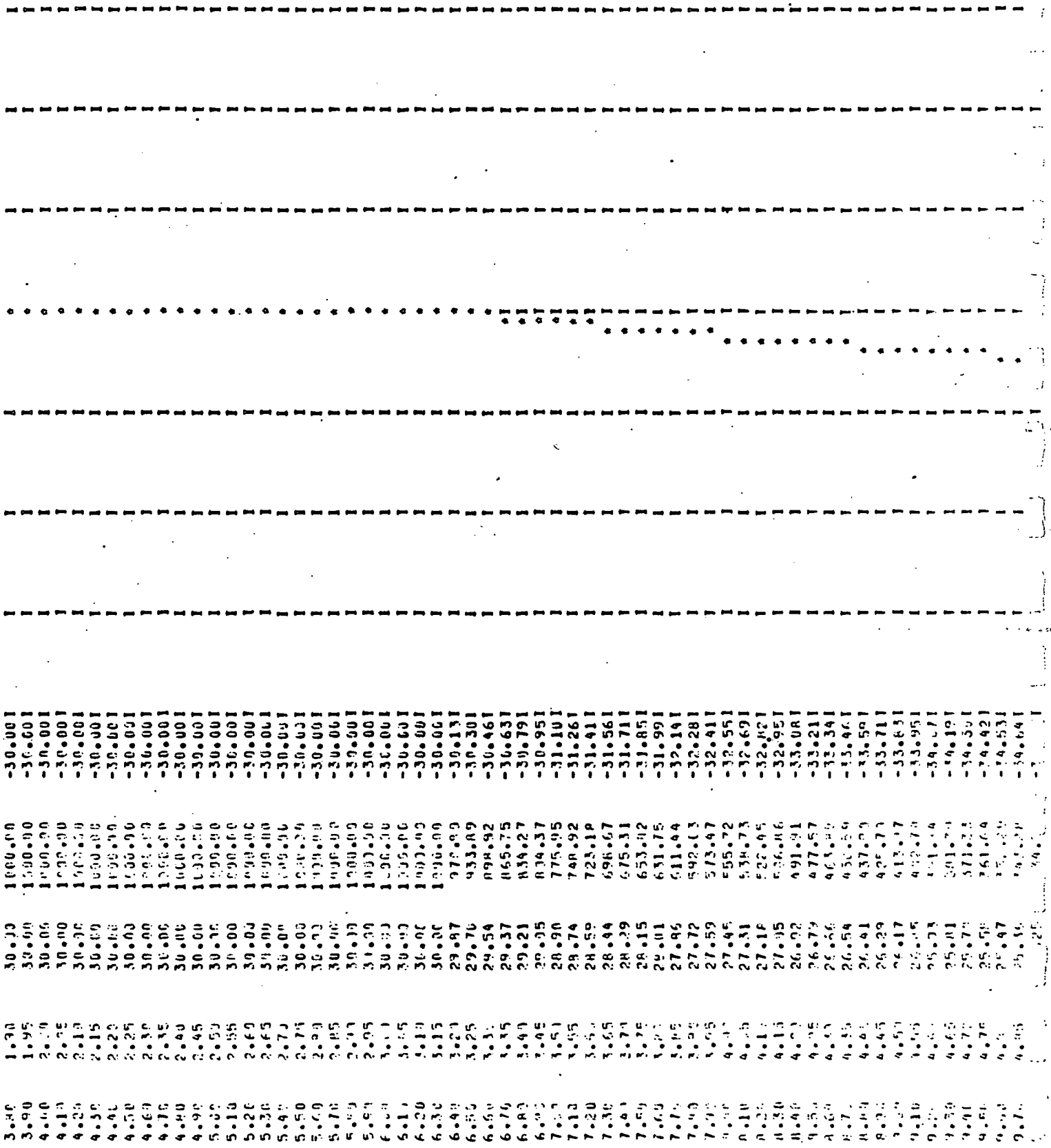
NGT= 6 LGET= 152 C

B

GAIN ENTRY TABLE

I	NGPAT	IGENT	IGCAL	IMOSEG	IMPARAM/ IEGTYP	PARAM/ LIMIT	PARAM/ NCOEFF	PARAM/ COEFF	PARAM/ COEFF	PARAM/ COEFF
					G	H				
5	1	1	0	4	77WARC SATELLITE TRANSMIT COPOLAR					
A	D	E	F	1	2	1.58000	3	12.0000	0.0	2.00000
				2	1	3.16000	1	30.0000		
			I→	3	3	998.000	4	17.5000	25.0000	1.00000
								0.0		
				4	4	999.000	2	0.0	0.0	

PHI J	PHI/PHIZ K	GAIN(DB) L	GAIN M	DGAIN N	-70	-60	-50	-40	-30	-20	-10	60A
0.0	0.00	60.00	999998.63	-0.00	I	I	I	I	I	I	I	*
0.10	0.05	59.97	993146.75	-0.03	I	I	I	I	I	I	I	*
0.20	0.10	59.88	972738.13	-0.12	I	I	I	I	I	I	I	*
0.30	0.15	59.73	939714.56	-0.27	I	I	I	I	I	I	I	*
0.40	0.20	59.52	895356.38	-0.48	I	I	I	I	I	I	I	*
0.50	0.25	59.25	841367.38	-0.75	I	I	I	I	I	I	I	*I
0.60	0.30	58.92	779823.19	-1.08	I	I	I	I	I	I	I	*I
0.70	0.35	58.53	712846.50	-1.47	I	I	I	I	I	I	I	*I
0.80	0.40	58.08	642682.13	-1.92	I	I	I	I	I	I	I	I
0.90	0.45	57.57	571473.81	-2.43	I	I	I	I	I	I	I	I
1.00	0.50	57.00	501183.06	-3.00	I	I	I	I	I	I	I	I
1.10	0.55	56.37	433507.31	-3.63	I	I	I	I	I	I	I	I
1.20	0.60	55.68	369825.69	-4.32	I	I	I	I	I	I	I	I
1.30	0.65	54.93	311171.13	-5.07	I	I	I	I	I	I	I	I
1.40	0.70	54.12	258225.06	-5.88	I	I	I	I	I	I	I	I
1.50	0.75	53.25	211749.50	-6.75	I	I	I	I	I	I	I	I
1.60	0.80	52.32	170208.31	-7.68	I	I	I	I	I	I	I	I
1.70	0.85	51.33	135631.69	-8.67	I	I	I	I	I	I	I	I
1.80	0.90	50.28	106669.16	-9.72	I	I	I	I	I	I	I	I
1.90	0.95	49.17	82694.44	-10.83	I	I	I	I	I	I	I	I
2.00	1.00	48.00	63196.35	-12.00	I	I	I	I	I	I	I	I
2.10	1.05	46.77	47934.26	-13.23	I	I	I	I	I	I	I	I
2.20	1.10	45.48	35819.27	-14.52	I	I	I	I	I	I	I	I
2.30	1.15	44.13	26492.73	-15.87	I	I	I	I	I	I	I	I
2.40	1.20	42.72	18707.39	-17.28	I	I	I	I	I	I	I	I
2.50	1.25	41.25	13335.58	-18.75	I	I	I	I	I	I	I	I
2.60	1.30	39.72	9375.96	-20.28	I	I	I	I	I	I	I	I
2.70	1.35	38.13	6591.83	-21.87	I	I	I	I	I	I	I	I
2.80	1.40	36.48	4646.51	-23.52	I	I	I	I	I	I	I	I
2.90	1.45	34.77	3299.38	-25.23	I	I	I	I	I	I	I	I
3.00	1.50	33.00	2335.37	-27.00	I	I	I	I	I	I	I	I
3.10	1.55	31.17	1649.85	-28.83	I	I	I	I	I	I	I	I
3.20	1.60	29.28	1166.16	-30.72	I	I	I	I	I	I	I	I
3.30	1.65	27.33	826.94	-32.67	I	I	I	I	I	I	I	I
3.40	1.70	25.32	586.08	-34.68	I	I	I	I	I	I	I	I
3.50	1.75	23.25	415.49	-36.75	I	I	I	I	I	I	I	I
3.60	1.80	21.12	295.06	-38.88	I	I	I	I	I	I	I	I
3.70	1.85	18.93	210.01	-41.07	I	I	I	I	I	I	I	I



4.2.2 P2 IERUNT

Program P2 of SOUP5, besides performing the single path calculations, checks the data for conditions which may cause an error. When it detects such an error, it writes a message to the unit IERUNT, and sets the stop code. If the error is not fatal the stop code (ISTOP) is set to 50. Detection of a fatal error sets the stop code to 99. There are no error messages written by Program P3.

Below is a list of error messages:

***WARNING - CHNLZTN SCHEME (scheme number) FOR IUP = (1 = up, 2 = down) VIOLATES RARC PARAMETERS, LOWEST FREQUENCY = lowest center channel frequency), NO. OF CHNLS = (number of channels in scheme), CHNL BNDWDTH = (channel bandwidth) GHZ

The error message is written by subroutine RDCHNL as a warning to the user that a channelization scheme violates the RARC parameters. The error is not fatal.

There is a violation of RARC parameters if:

1. $F_L - B_W/2$ is greater than $G_L + R_L$

2. $F_L + (N_c - 1) * S_c$ is greater than $R_u - G_u$

Where

F_L = center frequency of lowest channel in channelization
B_W = Channel bandwidth
G_L = Lower Guard Bandwidth
R_L = RARC Lower Bandedge Frequency
N_c = Number of Channels in Channelization
S_c = Channel Separation
R_u = RARC Upper Bandedge Frequency
G_u = Upper Guard Bandwidth

***WARNING MORE THAN ONE CHANNELIZATION SCHEME FOR IUP = (1 = up, 2 = down). NO MARGINS WILL BE CALCULATED.

This warning is written by subroutine RDCHNL. The conditions noted in the message make meaningful calculations of protection ratios and interference categories (e.g. co-channel, upper adjacent channel, etc.) impossible. Consequently all interference is considered co-channel with a protection ratio of 0 dB.

***WARNING - THE (test point number)The TEST POINT, WHICH BELONGS TO SERVICE AREA (administration - area - area type) IS OVER THE HORIZON FROM ITS OWN SATELLITE

This error is written by RWPOIN. The most probable cause of this error is forgetting to put a minus sign (-) on a west longitude, either for the ground point or the satellite location.

***FAILURE IN SUBROUTINE ELTLN - PATHOLOGICAL ELLIPSE. SATELLITE LONGITUDE = (satellite longitude)

This fatal error is caused by an ellipse, grazing the limb of the earth. Neither of the two points along the major axis halfway between the center and the edge intersects the Earth's surface. This cannot happen if the ellipse was generated correctly, but can happen if an ellipse is used from an orbital position other than the one used for its generation.

4.3 P3 OUTPUTS

Program P3 generates the following reports. Also listed with each report is the index of IOUTOP which controls the output a flag of "Y" for the appropriate IOUTOP on card 3 of the scenario will cause the report to be produced.

REPORT	IOUTOP INDEX
• Aggregate Interference up (only if up calculations requested)	1
• Aggregate Interference Down (only if down calculations requested)	1
• Aggregate Interference Total (only if up and down calculations requested)	1
• Detail Report #1 (for no block allocation)	2
• Detail Report #1 Co-polarized (for block allocation only)	2
• Detail Report #1 Cross-polarized (for block allocation only)	2
• Detail Report #2	3
• Interference Matrix Input Report	5

Each field is described below with a label. Following the description are labeled copies of each report.

DESCRIPTION OF AGGREGATE REPORT FIELDS

A	Scenario key
B	Block code (a blank means not a block member) (This field is blank if block allocation is not being used)
C	Administration, area, and area type of interfered service area
D	Satellite east longitude (deg)
E	Latitude of feederlink transmitter giving weakest signal (deg)
F	Longitude of weakest feederlink transmitter (deg)
G	Administration, area, and area type of worst co-channel interfering service area
H	Co-channel carrier to interference ratio (dB)
I	Co-channel margin (dB)
J	Upperadjacent channel carrier to interference ratio (dB)
K	Upper adjacent margin (dB)
L	Lower adjacent channel carrier to interference ratio (dB)
M	Lower adjacent margin (dB)
N	Next upper adjacent channel carrier to interference ratio (dB)
O	Next upper adjacent margin
P	Next lower adjacent channel carrier to interference ratio (dB)
Q	Next lower adjacent margin
R	Total margin (dB). The numerical sum of all the margins
S	Test point latitude (deg)
T	Test point longitude (deg)

Only those interfered service areas whose total margin (R) is less than the report margin (RPTMGN from scenario level file) are printed in this report. A value of 100. in RPTMGN will cause all service areas to be printed.

A

BLOCK CODE	SERVICE AREA	SAT LONG	TEST POINT LAT	TEST POINT LONG	WST-INTFR	CO CHANNEL C/I	CO CHANNEL MARGN	UPPER-ADJ C/I	UPPER-ADJ MARGN	LOWER ADJ C/I	LOWER ADJ MARGN	NEXT UPPER C/I	NEXT UPPER MARGN	NEXT LOWER C/I	NEXT LOWER MARGN		TOTAL MARGN
	CUBO1STD	-99.0	23.0	-82.4	USACTSTC	42.6	12.6	99.0	99.0	31.1	13.9	99.0	99.0	99.0	99.0	***	10.2
	ATN 1STD	-127.0	12.0	-69.0	USAEASTC	40.8	10.8	40.7	23.5	99.0	99.0	99.0	99.0	99.0	99.0	***	10.5
	CANMASTD	-140.0	45.3	-66.2	USACTSTC	22.2	-7.8	99.0	99.0	36.1	18.0	99.0	99.0	99.0	99.0	***	-7.8
	USACTSTC	-135.0	41.8	-87.7	CANMASTD	17.8	-12.2	99.0	99.0	30.5	13.3	99.0	99.0	99.0	99.0	***	-12.2
		-135.0	48.0	-89.5	CANMASTD	18.6	-11.4	99.0	99.0	31.4	14.3	99.0	99.0	99.0	99.0	***	-11.4
	USAEASTC	-115.0	40.7	-76.0	ATN 1STD	65.4	35.4	32.9	15.8	99.0	99.0	99.0	99.0	99.0	99.0	***	15.7
		-115.0	44.8	-66.9	ATN 1STD	63.1	33.1	30.1	13.0	99.0	99.0	99.0	99.0	99.0	99.0	***	12.9
		-115.0	47.4	-69.2	ATN 1STD	64.7	34.7	30.5	13.3	99.0	99.0	99.0	99.0	99.0	99.0	***	13.3
		-115.0	46.6	-90.5	ATN 1STD	66.1	36.1	30.6	13.4	99.0	99.0	99.0	99.0	99.0	99.0	***	13.4
		-115.0	47.5	-88.0	ATN 1STD	66.7	36.7	31.2	14.0	99.0	99.0	99.0	99.0	99.0	99.0	***	14.0
		-115.0	38.7	-87.6	ATN 1STD	66.2	36.2	32.4	15.3	99.0	99.0	99.0	99.0	99.0	99.0	***	15.3

B C D S T G H I J K L M N O P Q R

A

BLOCK CODE	SERVICE AREA	SAT LONG	TEST POINT LAT	TEST POINT LONG	CO-CHANNEL C/I	CO-CHANNEL MARGN	UPPER-ADJ C/I	UPPER-ADJ MARGN	LOWER ADJ C/I	LOWER ADJ MARGN	NEXT-UPPER C/I	NEXT-UPPER MARGN	LOWER ADJ C/I	LOWER ADJ MARGN		TOTAL MARGIN
	CUBO1STD	-99.0	23.0	-82.4	42.6	12.6	99.0	99.0	31.1	13.9	99.0	99.0	99.0	99.0	***	10.2
	ATN 1STD	-127.0	12.0	-69.0	40.8	10.8	40.7	23.5	99.0	99.0	99.0	99.0	99.0	99.0	***	10.5
	CANMASTD	-140.0	45.3	-66.2	22.2	-7.8	99.0	99.0	36.1	19.0	99.0	99.0	99.0	99.0	***	-7.8
	USACTSTC	-135.0	41.8	-87.7	17.8	-12.2	99.0	99.0	30.5	13.3	99.0	99.0	99.0	99.0	***	-12.2
		-135.0	48.0	-89.5	18.6	-11.4	99.0	99.0	31.4	14.3	99.0	99.0	99.0	99.0	***	-11.4
	USAEASTC	-115.0	40.7	-76.0	65.3	35.3	32.9	15.7	99.0	99.0	99.0	99.0	99.0	99.0	***	15.7
		-115.0	44.8	-66.9	63.1	33.1	30.1	13.0	99.0	99.0	99.0	99.0	99.0	99.0	***	12.9
		-115.0	47.4	-69.2	64.7	34.7	30.5	13.3	99.0	99.0	99.0	99.0	99.0	99.0	***	13.3
		-115.0	46.6	-90.5	66.0	36.0	30.5	13.4	99.0	99.0	99.0	99.0	99.0	99.0	***	13.4
		-115.0	47.5	-88.0	66.6	36.6	31.2	14.0	99.0	99.0	99.0	99.0	99.0	99.0	***	14.0
		-115.0	38.7	-87.6	66.1	36.1	32.4	15.3	99.0	99.0	99.0	99.0	99.0	99.0	***	15.2

B C D S T H I J K L M N O P Q R

4.4 P3 DETAIL REPORTS

Two detail reports are available to the user, Detail Report #1, and Detail Report #2. These reports are produced whenever there is a flag value of "Y" in column 11 and 12 respectively Scenario Record 3.

When block allocation is specified two copies of Detail Report #1 are produced, the first showing the results for co-polarized signal, the second for the cross-polarized signal.

Both of the detail reports, #1 and #2 contain one line for each link equation calculation whose carrier-to-interference value (C/I) is less than the detail report threshold (Scenario Record 3, columns 30-34 for up, 35-39 for down, and Data.Control record 1, columns 33-37 for up and 38-42 for down).

A link calculation may not be done for three reasons.

- The satellite and earth station are over each other's horizon by more than HORIZ km (HORIZ is in columns 68-73 of Scenario Card-3)

- The two service areas have non-interfering channel families

- The calculation is inhibited by the interference matrix (see pages 3-83 and 3-84 above).

When no calculation is done the fields are filled with flag values. The flag value for C/I is 200 dB. If the detail report threshold is greater than 200, the lines filled with flag values will be written. A description of each field follows. Beyond the descriptions are labeled copies of the reports.

OUTPUT FIELDS FOR DETAIL REPORTS

LABELED AS	CONTAINS
A	Name of interfered service area
B	Name of interfering service area
C	Satellite longitude (deg - E)
D	Earth station latitude (deg - N)
E	Earth station longitude (deg - E)
F	Carrier-to-interference ratio (dB) for interference signals (i.e. field A and B are different). Carrier-to-noise ratio (dB) for carrier signal. This field has a flag value for the C/N value in the cross-polarized Detail Report #1 (block allocation only), as C/N has no meaning and C/I cannot be calculated when the line is written
G	Power flux density at receiving antenna (dB - W/M^2)
H	Received power (dB - W)
I	Earth station co-polarized antenna gain (dB)
J	Earth station cross-polarized antenna gain (dB)
K	Satellite co-polarized antenna gain (dB)
L	Satellite cross-polarized antenna gain (dB)
M	Equivalent gain (dB)
N	Interference category. For non-grouping there are five positions; corresponding respectively to co-channel, upper-adjacent, lower-adjacent, next-upper-adjacent, and next-lower-adjacent; each marked with a "Y" (for yes) or "N" (for no). Because interference category is meaningless for grouping, in that case the field as a value of "BLK-ALOC"
O	Relative polarization "Co" = co-polarized "X" = cross-polarized blank= neither
P	Transmitter Power (dBW)
Q	Rain attenuation (dB)
R	Cross polar discrimination (dB)
S	Cant angle (deg) for linear polarization. For circular polarization it is given a value of 45^o

OUTPUT FIELDS FOR DETAIL REPORTS
(Continued)

LABELED AS	CONTAINS
T	Elevation angle of satellite as seen from Earth station
U	Earth station antenna off axis angle (deg)
V	Satellite antenna off axis angle (deg)
W	Slant range (10^6m)
X	Earth station antenna on-axis gain (dB)
Y	Satellite antenna on-axis gain (dB)
Z	Relative polarization angle (deg). For block allocation this field has a flag value
AA	Frequency (gHz) of transmitter
AB	Rain zone of earth station
AC	Earth station antenna beamwidth (deg)
AD	Satellite antenna beamwidth (deg) in direction of earth station (function of beam ellipse orientation)
AE	Same-block flag Y = same block N = different blocks blank = block allocation not in use
AF	Detail Report C/I Threshold (lines with a C/I less than this value are not printed)
AG	Total C/N (printed on down only)

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	AG
ANNAPOLIS		-144.5	70.0	-130.0	24.42	-93.81	-99.96	37.22	12.22	37.81	7.77	76.55	CARRIER	CO	31.10	13.4
		-144.5	70.0	-130.0	0.00	-93.81	-99.96	37.22	12.22	37.81	7.77	76.55	N NN NN	CO	31.10	
		-129.0	70.0	-130.0	45.63	-108.14	-145.59	4.70	4.96	16.27	8.50	30.84	N NN NN	X	31.18	
		-135.0	60.0	-130.0	56.94	-128.67	-159.90	12.93	7.22	11.63	3.86	23.73	N NN NN	X	24.30	
ANNAPOLIS		-144.5	60.0	-130.0	24.42	-93.81	-99.96	37.22	12.22	37.81	7.77	76.55	CARRIER	CO	31.10	13.4
		-144.5	60.0	-130.0	0.00	-93.81	-99.96	37.22	12.22	37.81	7.77	76.55	N NN NN	CO	31.10	
		-129.0	60.0	-130.0	45.63	-108.14	-145.59	4.70	4.96	16.27	8.50	30.84	N NN NN	X	31.18	
		-135.0	60.0	-130.0	56.94	-128.67	-159.90	12.93	7.22	11.63	3.86	23.73	N NN NN	X	24.30	
ANNAPOLIS		-144.5	49.0	-114.0	18.15	-100.09	-106.23	37.22	12.22	37.81	7.77	70.16	CARRIER	CO	31.10	12.5
		-144.5	49.0	-114.0	0.00	-100.09	-106.23	37.22	12.22	37.81	7.77	70.16	N NN NN	CO	31.10	
		-129.0	49.0	-114.0	32.27	-100.10	-138.50	4.46	4.96	32.68	8.50	37.66	N NN NN	X	31.18	
		-135.0	49.0	-114.0	53.54	-128.44	-159.77	12.31	7.22	11.63	3.86	23.64	N NN NN	X	24.30	
		-70.0	49.0	-114.0	96.54	-164.69	-202.78	-0.78	-0.78	0.00	0.00	5.24	N NN NN	X	0.00	
ANNAPOLIS		-144.5	70.0	-130.0	23.79	-94.45	-100.59	37.22	12.22	37.81	7.77	75.03	CARRIER	CO	31.10	13.5
		-144.5	70.0	-130.0	0.00	-94.45	-100.59	37.22	12.22	37.81	7.77	75.03	N NN NN	CO	31.10	
		-129.0	70.0	-130.0	50.74	-115.90	-151.34	4.46	4.96	16.27	8.50	24.20	N NN NN	X	31.18	
		-135.0	70.0	-130.0	58.45	-128.06	-159.05	12.77	7.22	11.29	3.86	23.64	N NN NN	X	24.30	
ANNAPOLIS		-144.5	47.0	-130.0	22.93	-95.31	-101.45	37.22	12.22	37.59	7.77	74.81	CARRIER	CO	31.10	13.4
		-144.5	49.0	-130.0	0.00	-95.31	-101.45	37.22	12.22	37.59	7.77	74.81	N NN NN	CO	31.10	
		-129.0	49.0	-130.0	51.02	-116.46	-152.47	4.41	4.96	16.27	8.50	23.66	N NN NN	X	31.18	
		-135.0	49.0	-130.0	58.27	-128.36	-159.72	12.59	7.22	11.63	3.86	23.51	N NN NN	X	24.30	
ANNAPOLIS		-144.5	81.0	-142.0	18.64	-102.60	-104.74	37.22	12.22	25.65	7.77	66.91	CARRIER	CO	31.10	11.7
		-144.5	81.0	-142.0	0.00	-102.60	-104.74	37.22	12.22	25.65	7.77	66.91	N NN NN	CO	31.10	
		-129.0	81.0	-142.0	42.85	-119.64	-151.06	5.08	4.96	16.27	8.50	24.52	N NN NN	X	31.18	
		-135.0	81.0	-142.0	50.64	-127.07	-159.46	13.03	7.22	11.63	3.86	23.04	N NN NN	X	24.30	
ANNAPOLIS		-144.5	80.0	-130.0	20.48	-95.58	-101.70	37.22	12.22	25.65	7.77	75.08	CARRIER	CO	31.10	12.4
		-144.5	80.0	-130.0	0.00	-95.58	-101.70	37.22	12.22	25.65	7.77	75.08	N NN NN	CO	31.10	
		-129.0	80.0	-130.0	50.93	-116.75	-152.63	4.41	4.96	16.27	8.50	24.30	N NN NN	X	31.18	
		-135.0	80.0	-130.0	58.65	-128.18	-159.88	12.59	7.22	11.63	3.86	23.64	N NN NN	X	24.30	
ANNAPOLIS		-144.5	60.0	-130.0	20.48	-95.58	-101.70	37.22	12.22	25.65	7.77	69.45	CARRIER	CO	31.10	12.2
		-144.5	60.0	-130.0	0.00	-95.58	-101.70	37.22	12.22	25.65	7.77	69.45	N NN NN	CO	31.10	
		-129.0	60.0	-130.0	50.93	-116.75	-152.63	4.41	4.96	16.27	8.50	29.85	N NN NN	X	31.18	
		-135.0	60.0	-130.0	58.65	-128.18	-159.88	12.59	7.22	11.63	3.86	29.85	N NN NN	X	24.30	
ANNAPOLIS		-144.5	70.0	-130.0	23.79	-94.45	-100.59	37.22	12.22	37.81	7.77	75.03	CARRIER	CO	31.10	13.5

AF

* SERVICE AREA * INTFERED	INTFRING	RAIN ATN DB	X-POL DISC DB	CANT ANGLE DEG	ELEV ANGLE DEG	* OFF-AXIS E.STA DEG	ANGLE* SAT DEG	SLNT RANGE 10**6 M	*ON-AXIS E.STA DB	GAIN* SAT DB	REL POL ANGLE DEG	FREQ GHZ	RN ZN	ANT-BMWDTH E.S. DEG	SAT DEG	SM BK
A	B	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE
AHORZTST	AHORZTST	10.33	21.68	67.82	-51.45	0.0	1.993	46.964	37.22	49.81	0.0	12.459	B	2.28	0.53	N
	AHORZTST	10.33	21.68	67.82	-51.45	0.0	1.993	46.964	37.22	49.81	0.0	12.459	B	2.28	0.53	N
	CANPASTD	0.0	99.00	-99.90	-99.90	-99.900	-99.900	46.833	37.22	40.77	-99.90	12.459	B	0.0	0.0	N
	CANPESTD	0.0	99.00	-99.90	-99.90	-99.900	-99.900	47.211	37.22	41.50	-99.90	12.473	B	0.0	0.0	N
	CANONSTD	0.0	99.00	-99.90	-99.90	-99.900	-99.900	0.0	37.22	40.62	-99.90	12.606	B	0.0	0.0	N
	USACTSTC	0.0	99.00	-99.90	-99.90	-99.900	-99.900	47.078	37.22	36.86	-99.90	12.415	B	0.0	0.0	N
	ATNTSPNT	0.0	99.00	-99.90	-99.90	-99.900	-99.900	45.643	37.22	49.81	-99.90	12.415	B	0.0	0.0	N
AHORZTST	AHORZTST	10.93	26.59	78.31	-54.07	0.0	2.885	47.161	37.22	49.81	0.0	12.459	B	2.28	0.53	N
	AHORZTST	10.93	26.59	78.31	-54.07	0.0	2.885	47.161	37.22	49.81	0.0	12.459	B	2.28	0.53	N
	CANPASTD	0.0	99.00	-99.90	-99.90	-99.900	-99.900	46.454	37.22	40.77	-99.90	12.459	B	0.0	0.0	N
	CANPESTD	0.0	99.00	-99.90	-99.90	-99.900	-99.900	47.078	37.22	41.50	-99.90	12.473	B	0.0	0.0	N
	CANONSTD	0.0	99.00	-99.90	-99.90	-99.900	-99.900	0.0	37.22	40.62	-99.90	12.606	B	0.0	0.0	N
	USACTSTC	0.0	99.00	-99.90	-99.90	-99.900	-99.900	46.817	37.22	36.86	-99.90	12.415	B	0.0	0.0	N
	ATNTSPNT	0.0	99.00	-99.90	-99.90	-99.900	-99.900	46.195	37.22	49.81	-99.90	12.415	B	0.0	0.0	N
CANPASTD	CANPASTD	1.44	42.21	88.73	11.43	0.0	1.544	40.433	37.22	40.77	0.0	12.459	B	2.28	2.69	N
	AHORZTST	2.18	30.01	-76.57	6.31	46.175	6.093	40.983	37.22	49.81	0.0	12.459	B	2.28	0.53	N
	CANPASTD	1.44	42.21	88.73	11.43	0.0	1.544	40.433	37.22	40.77	0.0	12.459	B	2.28	2.69	N
	CANPESTD	1.80	38.48	-5.73	10.64	20.322	2.756	40.516	37.22	41.50	90.00	12.473	B	2.28	1.79	N
	CANONSTD	0.0	99.00	-99.90	-99.90	-99.900	-99.900	0.0	37.22	40.62	-99.90	12.606	B	0.0	0.0	N
	USACTSTC	1.71	41.71	-2.18	11.36	9.906	5.690	40.441	37.22	36.86	90.00	12.415	B	2.28	3.30	N
	ATNTSPNT	0.0	99.00	-99.90	-99.90	-99.900	-99.900	41.935	37.22	49.81	-99.90	12.415	B	0.0	0.0	N
CANPASTD	CANPASTD	1.64	35.54	81.42	9.55	0.0	0.704	40.633	37.22	40.77	0.0	12.459	B	2.28	1.22	N
	AHORZTST	1.57	37.08	-82.90	10.18	46.312	5.260	40.565	37.22	49.81	0.0	12.459	B	2.28	0.53	N
	CANPASTD	1.64	35.54	81.42	9.55	0.0	0.704	40.633	37.22	40.77	0.0	12.459	B	2.28	1.22	N
	CANPESTD	1.72	41.93	1.82	11.39	20.289	1.693	40.437	37.22	41.50	90.00	12.473	B	2.28	1.95	N
	CANONSTD	0.0	99.00	-99.90	-99.90	-99.900	-99.900	0.0	37.22	40.62	-99.90	12.606	B	0.0	0.0	N
	USACTSTC	1.78	38.85	5.38	10.74	9.872	4.743	40.506	37.22	36.86	90.00	12.415	B	2.28	3.55	N
	ATNTSPNT	3.29	26.67	-15.58	4.02	77.138	13.684	41.233	37.22	49.81	90.00	12.415	B	2.28	0.53	N
CANPASTD	CANPASTD	1.46	34.44	76.54	18.83	0.0	0.366	39.670	37.22	40.77	0.0	12.459	B	2.28	1.07	N
	AHORZTST	1.40	36.15	-78.83	19.84	47.526	5.562	39.569	37.22	49.81	0.0	12.459	B	2.28	0.53	N
	CANPASTD	1.46	34.44	76.54	18.83	0.0	0.366	39.670	37.22	40.77	0.0	12.459	B	2.28	1.07	N
	CANPESTD	1.52	43.18	2.88	21.80	20.812	1.436	39.376	37.22	41.50	90.00	12.473	B	2.28	1.68	N
	CANONSTD	0.0	99.00	-99.90	-99.90	-99.900	-99.900	0.0	37.22	40.62	-99.90	12.606	B	0.0	0.0	N
	USACTSTC	1.56	38.31	8.50	20.75	10.119	4.147	39.480	37.22	36.86	90.00	12.415	B	2.28	3.49	N
	ATNTSPNT	2.50	26.27	-23.86	10.18	79.003	14.304	40.565	37.22	49.81	90.00	12.415	B	2.28	0.53	N
CANPASTD	CANPASTD	1.51	31.43	66.19	26.65	0.0	1.714	38.915	37.22	40.77	0.0	12.459	B	2.28	2.70	N
	AHORZTST	1.32	38.21	-78.12	32.18	48.767	5.275	38.419	37.22	49.81	0.0	12.459	B	2.28	0.53	N
	CANPASTD	1.51	31.43	66.19	26.65	0.0	1.714	38.915	37.22	40.77	0.0	12.459	B	2.28	2.70	N
	CANPESTD	1.47	39.97	9.42	32.78	21.282	0.816	38.367	37.22	41.50	90.00	12.473	B	2.28	1.03	N
	CANONSTD	0.0	99.00	-99.90	-99.90	-99.900	-99.900	0.0	37.22	40.62	-99.90	12.606	B	0.0	0.0	N
	USACTSTC	1.53	34.90	17.30	30.26	10.327	2.808	38.587	37.22	36.86	90.00	12.415	B	2.28	3.39	N
	ATNTSPNT	1.99	27.40	-31.13	19.99	81.149	14.531	39.555	37.22	49.81	90.00	12.415	B	2.28	0.53	N

DESCRIPTION OF MATRIX ECHO REPORTS
(PRINTED ON P3-IDIAG)

Each line describes an Interferer-Interfered calculation which is suppressed by the interference matrix (see pages 3-83 through 3-84).

A	Service area number of Interferer
B	Service area Key of Interferer
C	Service area Group of Interferer
D	Service area Index of Interfered
E	Service area Key of Interfered
F	Service area Group of Interfered

INTERFERENCE CALCULATIONS NOT PERFORMED FOR

#	SERVICE AREA-GROUP		TO	#	SERVICE AREA-GROUP	
4	CANONSTD	CANC	TO	4	CANONSTD	CANC
4	CANONSTD	CANC	TO	5	USACTSTC	
5	USACTSTC		TO	4	CANONSTD	CANC
5	USACTSTC		TO	5	USACTSTC	

V. BINARY OUTPUT

5.1 Program 1 Binary Output

Program 1 writes the Binary files OUT.B.CTL, OUT.B.UP and OUT.B.DWN which contain control data, uppath data and downpath data respectively for Program 2 input. The content and structure of this file, which does not affect the user, is documented in the SOUP5 Programmer's Manual.

5.2 Program 2 Binary Output

Program 2 writes two binary output files P2.IOUTBN and P2.IOUTB2 for use as input for Program 3. As with the Program 1 binary output, the structure and content of the files is documented in the Programmer's Manual.

5.3 Program 3 Binary Output

If column 13 of Card-3 of the scenario contains a "Y", Program 3 writes binary records containing the details of the link equation calculations. The records are available to a report generator.

As with the two detail reports (see 4.4 above) there is one record for each link equation calculation. Every record contains all the information in the two detail reports as well as some additional information.

Each record is generated by one FORTRAN binary write statement. The contents of each record is shown below.

SOUP5 BINARY OUTPUT
UNIT - IOUTBN

NOTE:
First character of variable name: I-N, Integer *4 or character (X),
A-H, O-Z, Real *4 or character (X).

NAME	DESCRIPTION (Units and Meaning)
IUP	PATH: 1 = up, 2 = down
IX1	Receiving Service Area Sequence Number
IX1GND	Receiving Service Area Ground Pt. Sequence Number (0 if up calculation)
IX2	Transmitting Service Area Sequence Number
IX2GND	Transmitting Service Area Ground Pt. Sequence Number (0 if down calculation)
ICALC	Link equation calculation sequence number (1, 2, ...)
ADMIN(IX1)	Receiving Service Area Administration XXX
AREA(IX1)	Receiving Service Area XX
ARTYPE(IX1)	Receiving Service Area Type XXX
ADMIN(IX2)	Transmitting Service Area Administration XXX
AREA(IX2)	Transmitting Service Area XX
ARTYPE(IX2)	Transmitting Service Area Type XXX
SLONG	Satellite Longitude (Rad)
SLAT	Satellite Latitude (Rad)
ERLATR	Ground Point Latitude (Rad)
ERLONR	Ground Point Longitude (Rad)
CICN(2)*	C/N when transmitting Service Area is same as receiver Service Area; C/I otherwise single (numerical)
PFD	Power Flux Density at receiver Watts/m^2
RCVPWR(2)*	Received Signal Power (Watts)
GAINGC	Gain-Ground Co-polar (Numerical)

*For no block allocation 1 = calculated value, 2 contains a flag value
For block allocation 1 is co-polarized value, 2 is cross polarized value

SOUP5 BINARY OUTPUT
UNIT - IOUTBN

NAME	DESCRIPTION (Units and Meaning)
GAINGX	Gain-Ground Cross-polar (Numerical)
GAINSC	Gain-Satellite Co-polar (Numerical)
GAINSX	Gain-Satellite Cross-polar (Numerical)
GAINEQ(2)*	Gain-Equivalent (Numerical)
INTCAT+	Interference Category 1 = Co-channel 2 = Upper adjacent channel 3 = Lower adjacent channel 4 = Next upper channel 5 = Next lower channel
ATN	Attenuation Due to Rain (Numerical)
XPDADJ	Cross-polar Discrimination (Numerical)
TILTD	Rain attenuation Cant Angle (Rad)
ELNSAT	Elevation
PHIGND	Off-axis Angle-Ground Antenna (Rad)
PHISAT	Off-axis Angle-Satellite Antenna (Rad)
SIGMA	Beam Ellipse Orientation Angle (Rad)
RANGE1	Slant Range (Meters)
GOAGND	On-axis Gain-Ground Antenna (Numerical)
GOASAT	On-axis Gain-Satellite Antenna (Numerical)
RELPOL+	Relative Polarization Angle (Rad)
FREQ1	Frequency-Receiver (Ghz)
FREQ2	Frequency-Transmitter (Ghz)
IRNZN	Rain Zone Ground (X)
PPRCUL (INCAT), INCAT = 1,5	Aggregate Protection Ratio for interference category INTCAT (Numerical)
PRRTOT (INCAT), INCAT = 1,5	Aggregate Total Protection Ratios for interference category INTCAT (Numerical)
TRPR	Transmitter Power (Watts)

+ Not meaningful for block allocation

* Same as previous page

SOUP5

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3. Modification of the Spectrum/Orbit Utilization Program - Final Report, Joyce Kerr, Peter Sawitz, Fred Zusman, ORI Technical Report 1802, October, 1980.

4. Spectrum/Orbit Utilization Program, User & Programmer's Manual by Joseph Davidson and Peter Sawitz, ORI Technical Reports

5. SOUP5 Programmer's Manual, in preparation.

END DATE

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